US AIR FORCE
INSTALLATION RESTORATION PROGRAM

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REMEDIAL INVESTIGATION REPORT

SHEPPARD AFB, TEXAS

TX 3 571 524 161

AIR TRAINING COMMAND

VOLUME I: TEXT

HEADQUARTERS AIR TRAINING COMMAND/DEEV
RANDOLPH AFB, TEXAS

OCTOBER 1990

R34892

NUS CORPORATION

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U.S. AIR FORCE
INSTALLATION RESTORATION PROGRAM

REMEDIAL INVESTIGATION REPORT
ELEVEN SITES

SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

HAZWRAP SUPPORT CONTRACTOR OFFICE
OAK RIDGE, TENNESSEE
GENERAL ORDER NUMBER 18B-97381C
TASK ORDER X-09

NUS PROJECT NUMBER 7S63

OCTOBER 1990

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLES

TABLES (CONTINUED)

FIGURES

FIGURES (CONTINUED)

FIGURES (APPENDIX I)

FIGURES (APPENDIX I)

EXECUTIVE SUMMARY

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INTRODUCTION

Under the Department of Defense (DOD) Installation Restoration Program (IRP), Air Training Command (ATC) and Sheppard Air Force Base (AFB) requested site investigations of 12 potentially hazardous waste sites located on Sheppard AFB. Martin Marietta Energy Systems, Inc., engaged NUS Corporation (NUS) to develop and execute Remedial Investigations (RIs) and, if required, Feasibility Studies (FSs) for eleven of these sites. This document presents the results of the RIs.

BACKGROUND INFORMATION

Sheppard AFB is located 4 miles north of Wichita Falls, Texas, which is in the north-central portion of the state and approximately 150 miles northwest of Dallas (Figures ES-1 and ES-2). The base is bordered by agricultural lands on the north and east, limited residential and commercial development on the south, and a major highway with commercial development on the west. Bear Creek flows through the northern section of the base property. Sheppard AFB proper consists of 5,249 acres, with an additional 359 acres at two remote locations.

Topography at the base is characterized by gently rolling hills separated by large, flat areas. Soils are generally poorly drained loam, comprised of silty and sandy clays derived from in-place weathering of the underlying bedrock. The bedrock at the base consists of Permian mudstone, sandstone, and siltstone, which is exposed at several locations. There is not a well-defined aquifer within these shaley Permian deposits. Depth to ground water varies widely, from less than 5 feet in the vicinity of the operational area and the golf course to more than 50 feet at Landfill 3.

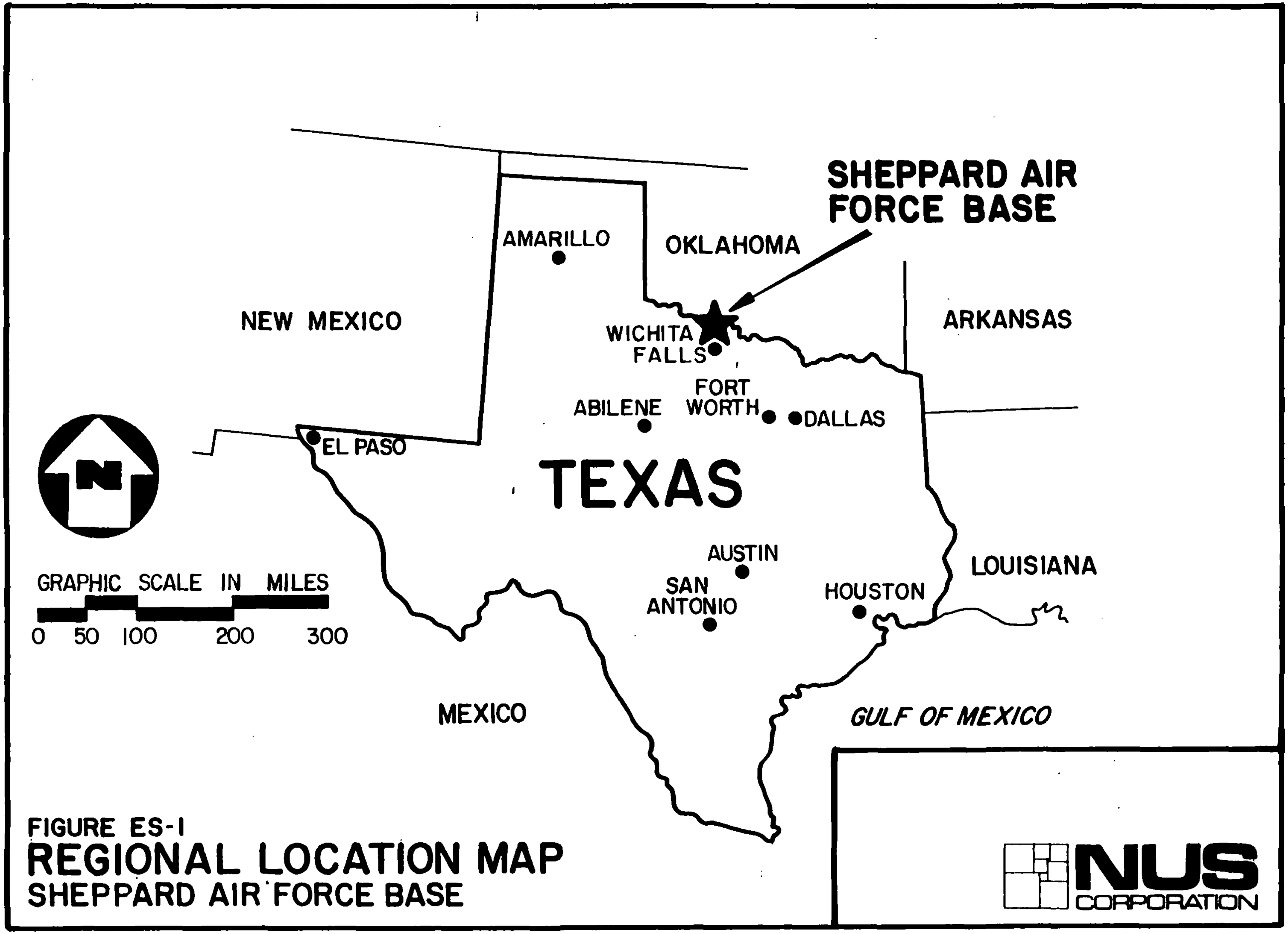
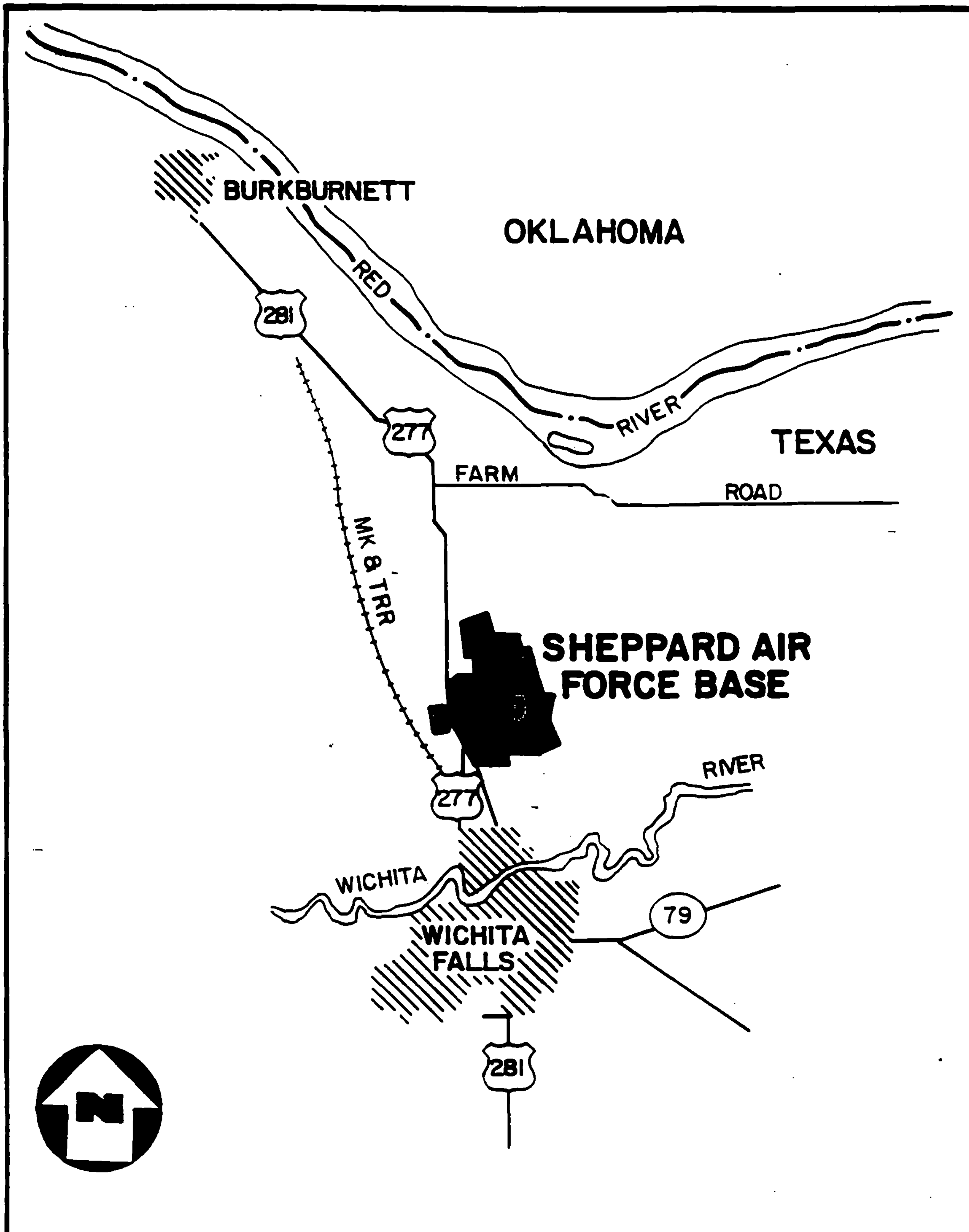


FIGURE ES-1
REGIONAL LOCATION MAP
SHEPPARD AIR FORCE BASE



1" = 3 MILES

FIGURE ES-2
AREA LOCATION MAP
SHEPPARD AIR FORCE BASE

SITE IDENTIFICATION

This document presents the results of investigations at the following Sheppard AFB sites:

- Site FT01 Fire Protection Training Area 1
- Site FT02 Fire Protection Training Area 2
- Site FT03 Fire Protection Training Area 3
- Site LF04 Landfill 1
- Site LF05 Landfill 2
- Site LF06 Landfill 3
- Site RW07 Low-Level Radioactive Waste Disposal Site 1
- Site RW08 Low-Level Radioactive Waste Disposal Site 2
- Site WP10 Industrial Waste Pit 2
- Site OT11 Pesticide Spray Area
- Site ST13 Former Underground Storage Tank Site

Waste Pit 1 (WP09), an additional waste pit site, was investigated previously by Radian Corporation 1987. However, the details are not presented in this document. Figure ES-3 shows the location of the twelve IRP sites identified at Sheppard AFB.

REMEDIAL INVESTIGATION GOALS

The goals of the RIs included the following:

- Acquisition of field data to assess the hydrogeologic setting of each site.
- Acquisition of site-specific chemical data.
- Identification of contaminants of concern.
- Identification of sites that require further action.
- Identification of sites that require no further action.
- Providing data for FSs and, if required, remedial design.

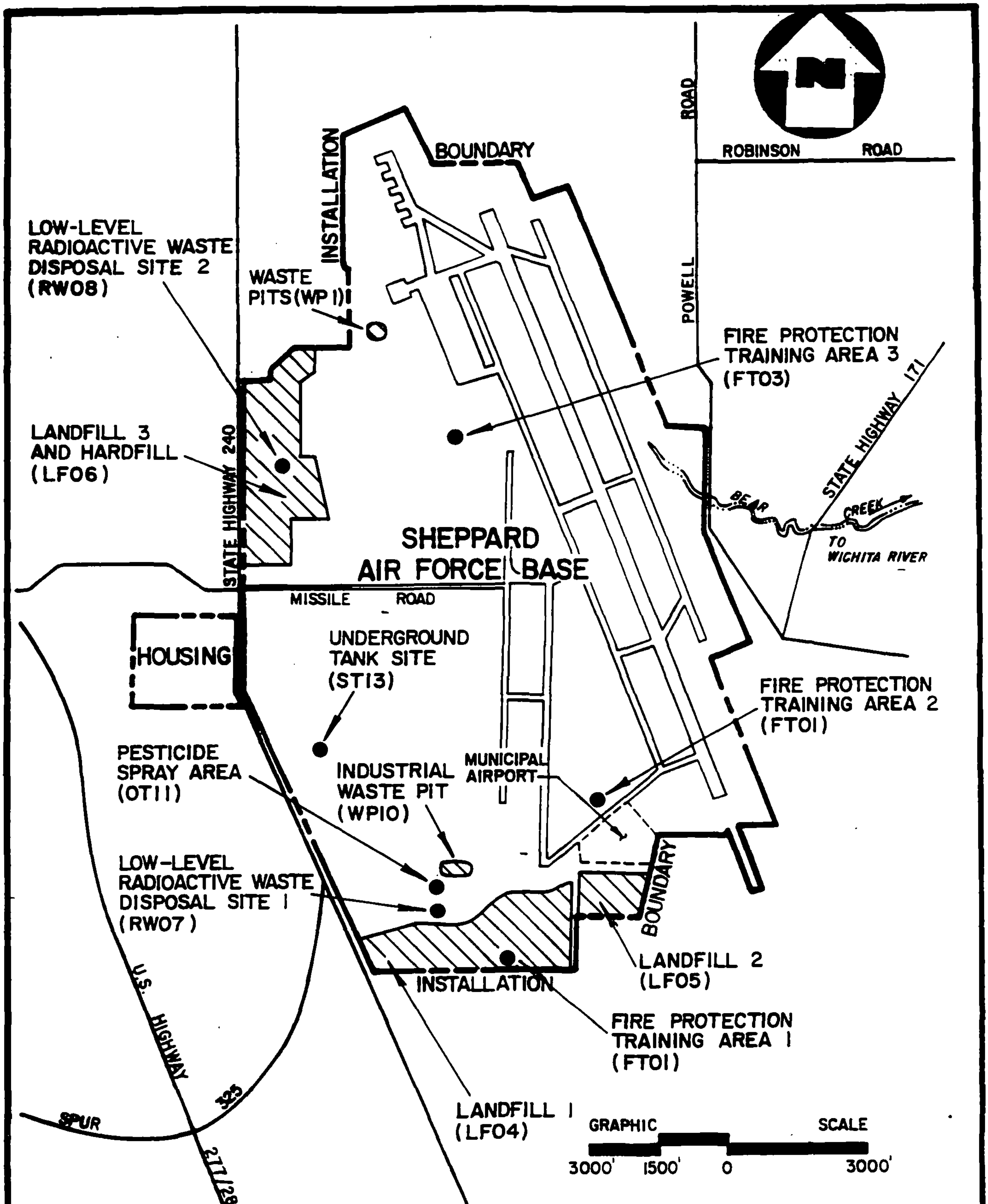


FIGURE ES-3
SITE LOCATION MAP
SHEPPARD AIR FORCE BASE

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REMEDIAL INVESTIGATION ACTIVITIES

The field program and data analysis performed during the remedial investigation consisted of the following activities:

- Geophysical surveying
- Soil borings
- Monitoring well installation
- Environmental sampling
- Laboratory analyses
- Data evaluation
- SOV survey

The initial field investigation, performed in the late fall and winter of 1988-1989, indicated a need for additional information on Sites LF04, LF05, RW08, WP10, and ST13. Further studies in July 1989 completed the field investigations. A summary of field investigation activities is shown in Table ES-1. The resulting data are the basis for the risk assessments contained in this document.

The risk assessments were based on the following criteria:

- Hazard identification
- Dose-response evaluation
- Exposure assessment
- Risk characterization

RESULTS OF REMEDIAL INVESTIGATION

The field program found no evidence of gross contamination of any of the 11 sites. The subsurface material at the sites consists of clayey silt and sand with no well-defined shallow aquifer system. The laboratory analyses substantiated the absence of significant soil or ground-water contamination. Elevated concentrations of pesticides were detected at sites LF04 and WP10.

Risk assessments were conducted for each site, using contaminant concentration and distribution data gathered during the field investigation and laboratory chemical analyses. Most sites were determined to contain contaminant concentrations similar to background levels. Standard risk assessment calculations indicated that none of the sites evaluated (including those with elevated contaminant concentrations) posed significant risk to human health or the environment. Based on these results, it appears that no remedial action is warranted for any of the 11 sites.

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TABLE ES-1

SUMMARY OF REMEDIAL INVESTIGATION ACTIVITIES
SHEPPARD AIR FORCE BASE

Site Number	Site Description	Geophysics			Drilling		Test Pits	Chemical Analytical Samples	
		Magnetometry	EMI[b]	Resistivity	Monitoring Wells	Borings		Soils/Sediment	Water
FT01	Fire Protection Training Area 1[a]		X	X	7	4	2	13	14
FT02	Fire Protection Training Area 2				0	5	0	9	0
FT03	Fire Protection Training Area 3[a]		X		5	0	0	6	11
LF04	Landfill 1				3	0	0	11	5
LF05	Landfill 2				3	1	0	20	6
LF06	Landfill 3[a]	X	X	X	4	3	0	13	15
RW07	Low-Level Radioactive Waste Disposal Site 1				0	0	1	0	0
RW08	Low-Level Radioactive Waste Disposal Site 2	X			1	0	0	1	2
WP10	Industrial Waste Pit				3	0	0	12	4
OT11	Pesticide Spray Area				0	2	0	4	0
ST13	Tank Removal Site	X			4	0	0	4	4
BB01	Base Background				1	0	0	2	1
	TOTAL	**3**	**3**	**2**	**31**	**15**	**3**	**95**	**62**

(a) Sites which include data from Radian (1987) report.
(b) Electromagnetic induction.

1

1.0 INTRODUCTION

1.1 PROGRAM BACKGROUND

In response to the Resource Conservation and Recovery Act (RCRA) of 1976 and in anticipation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, the U.S. Air Force (USAF) implemented the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6, dated June 1980 (rev. DEQPPM 81-5, December 1981). The IRP at USAF installations and facilities was concurrently implemented. The IRP is a multi-phased investigative and remedial effort designed to identify and evaluate past material disposal or spill sites and to control potential migration of environmental contamination. The magnitude of contamination is to be quantified by analysis of appropriate soil, sediment, water, and air samples. Data from these analyses are used to assess potential human health and environmental risks. The IRP was originally developed and implemented as follows:

- Phase I - Records Search and Hazard Assessment Rating Methodology Site Ranking
- Phase II - Confirmation and Quantification Studies (staged efforts)
- Phase III - Technology Development
- Phase IV - Remedial Action

This four-phased approach to the IRP has been changed to ensure consistency between the IRP and other national hazardous waste cleanup programs. The terminology and procedures for the IRP have been changed to match those given in the National Contingency Plan as follows:

- PA/SI - Preliminary Assessment/Site Inspection
- RI/FS - Remedial Investigation/Feasibility Study
- RD/RA - Remedial Design/Remedial Action

1.2 AUTHORITY

The Hazardous Waste Remedial Action Program (HAZWRAP) of Martin Marietta Energy Systems, Inc., and its subcontractor, NUS Corporation (NUS), have conducted a Remedial Investigation (RI) of 11 hazardous waste disposal or spill sites at Sheppard Air Force Base (AFB), Texas. The RI was performed under authorization to HAZWRAP by the United States Air Force, Air Training Command (ATC), and in accordance with Work Plans prepared by NUS in September 1988 and July 1989.

1.3 SCOPE

The scope of the RI consists of data collection, analysis, and evaluation of 11 potentially hazardous waste sites at Sheppard AFB.

Data generated by the field investigations and laboratory analyses provided:

- Identification and concentration of contaminants.
- Site-specific geologic descriptions.
- An understanding of ground-water conditions.
- Identification of contaminant migration pathways.
- A data base for future investigations or remedial design.

In addition, wells installed during the field investigation may be used for long-term monitoring, if desired.

These data were used to calculate the risks to public health and the environment posed by each site. The risk assessment process is designed to lead to one of the following conclusions for each site.

- Site conditions represent no significant environmental threat.
- Site conditions may represent an environmental threat.
- Insufficient information is available to confirm the existence or extent of an environmental threat.

Each possibility, in turn, suggests a course of action:

- No significant threat - prepare a decision document recommending no further action at the site.

- Significant threat exists - use the data base and risk assessment evaluation to develop alternatives for site management and remediation.

- Insufficient data - acquire additional data.

1.4 AVAILABLE DATA AND PREVIOUS STUDIES

The present investigation was preceded by two earlier IRP investigations, both of which specifically addressed the sites at Sheppard AFB. The reports generated during the two previous investigations included a Phase I records search (Engineering-Science, 1984) and a Phase II, Stage I, field investigation (Radian, 1987).

The records search, commonly referred to as the "Phase I Report" is roughly the equivalent of the PA/SI. The authors conducted interviews, performed file searches and field surveys, and evaluated the sites using the Hazard Assessment Rating Methodology (HARM). The Phase I Report presents information regarding the regional and local environment, the status of identified sites, the past use of the sites, and the relative hazards posed by each site.

The Radian (1987) report, commonly referred to as the "Phase II Report," an early stage of the RI contains the results of field investigations conducted between October 1984 and February 1985. These investigations were conducted at four of the waste sites (WP09, LF06, FT01 and FT03), and included geophysical surveys, the installation and sampling of nine ground-water monitoring wells, coring and sampling of shallow soils at WP09 and FT01, and surface-water sampling from seven locations near the waste sites.

In September 1988, NUS submitted an IRP RI Final Work Plan (NUS, 1988). This document describes the investigation rationale for the 1988 field work performed by NUS. Based on the results of this field work and the addition of a new site (ST13), an addendum to the Work Plan was submitted in June 1989. The addendum provides the rationale for additional investigation activities performed at Sites LF04, LF05, WP10, and OT11, as well as the investigation performed at ST13.

The United States Geological Survey (USGS), Water Resources Division, completed a geologic investigation of Sheppard AFB in 1988 (USGS, 1988). Other general references have been used during this investigation and are referenced in the RI Report, as appropriate.

1.5 OVERVIEW OF REMEDIAL INVESTIGATION REPORT

The RI Report is presented in the following format. Section 2.0 provides a historical, geological, and hydrogeological background of the Sheppard AFB area. Section 3.0 includes a list of abbreviations and acronyms used within this document.

An overview of the various activities involved in the data collection and evaluation is provided in Section 4.0. Although the rationale for each phase of the investigation is presented in the Work Plan, brief summaries of each are provided in this section. Field investigation activities are reviewed in Section 4.2. A summary of laboratory chemical analyses chosen is included in Section 4.3. Sections 4.4 and 4.5 introduce general contaminant fate and transport and risk assessment terms and methodologies, respectively.

Site-by-site RI findings and conclusions are presented in Sections 5.0 through 16.0. Each section summarizes the field investigations performed at a particular site, stratigraphic information, and distribution of contaminants. The potential public health risks of each site are described, as well as recommendations for further action, based on risk assessment calculations.

2

2.0 BACKGROUND

2.1 BASE LOCATION AND FUNCTION

Sheppard AFB encompasses 5,249 acres of Wichita County, Texas, and is located about 4 miles north of the City of Wichita Falls in the north central portion of the state (Figure 2-1). Sheppard Field was activated as a pilot training school in 1941 and was subsequently deactivated in 1946. Sheppard AFB was activated at the Sheppard Field location in 1948. The base has remained active since that date, having assumed numerous training responsibilities from other bases. Presently, the major tenant organizations at Sheppard include: 80th Flying Training Wing (FTW); Air Force Audit Agency Office; 2054th Communications Squadron; 3314th Management Engineering Squadron, Detachment 5; 24th Weather Squadron, Detachment 12; Federal Aviation Administration (FAA) Representative; and Headquarters, Air Force Commissary Service.

2.2 PHYSICAL CHARACTERISTICS OF THE BASE AREA

2.2.1 Surface Features

Sheppard AFB is located in an area of gently rolling hills separated by large, flat plains typical of the Central Rolling Red Plains. The area lies between the valleys of the Red and Wichita Rivers, although the base itself is located solely within the Wichita River drainage basin. The base is bordered by agricultural lands on the north and east, limited residential and commercial development on the south, and a major highway with commercial development on the west. Elevations at the base range from about 1,075 feet mean sea level (MSL) near the base hospital to about 970 feet MSL where an unnamed creek leaves the southern portion of the base (Figure I-1 in Appendix I).

2.2.2 Meteorology

The Wichita Falls area experiences rather variable weather characterized by moderate winters and hot summers. Violent thunderstorms, with occasional tornado activity, are common in late spring and early summer. The mean annual

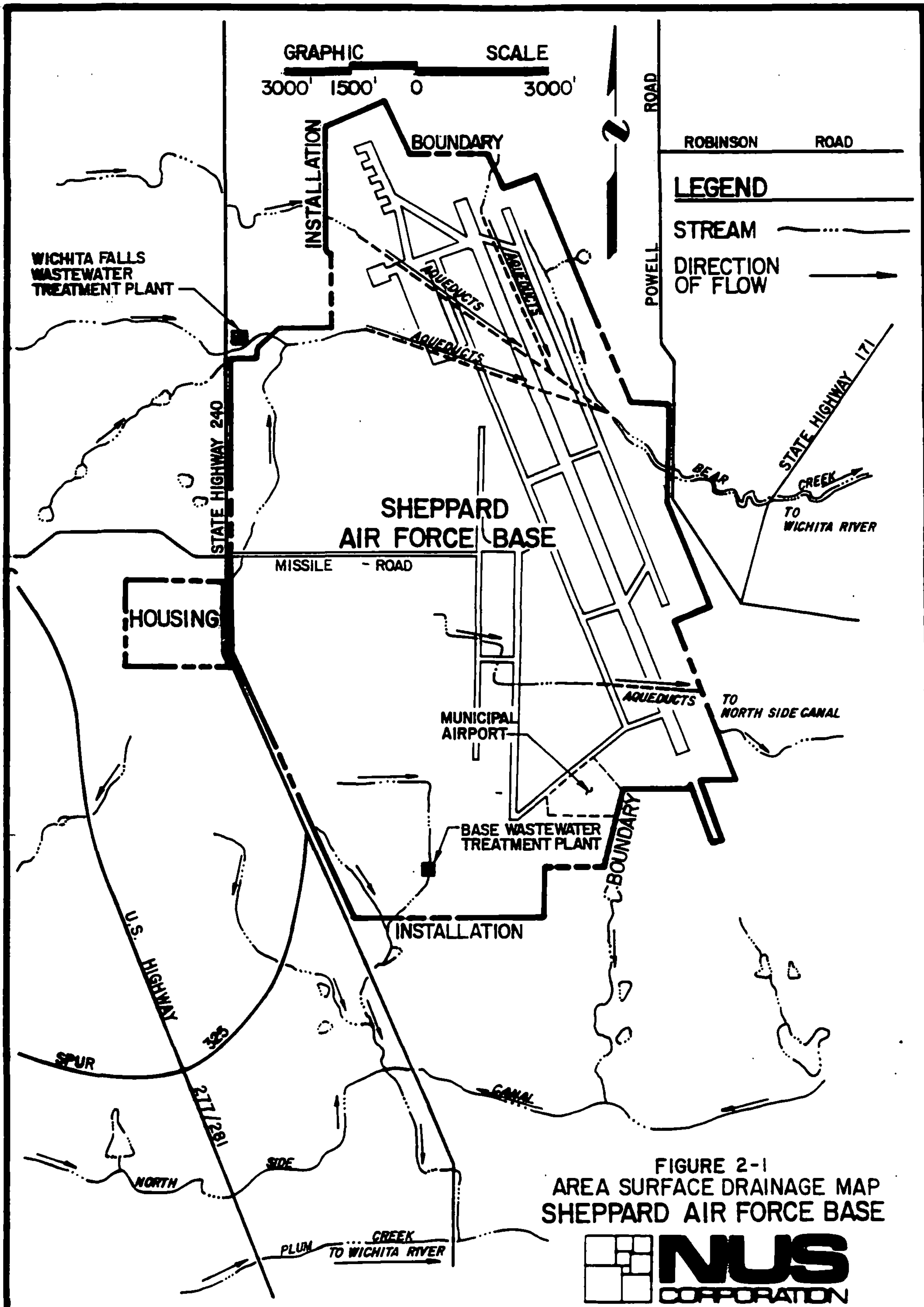

FIGURE 2-1
AREA SURFACE DRAINAGE MAP
SHEPPARD AIR FORCE BASE

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precipitation at Sheppard AFB is 27.08 inches (Engineering-Science, 1984), with most rainfall occurring between April and October. Snowfall is generally light, averaging about 7 inches per year. The mean average daily high temperature ranges from 98°F in July to 52°F in January. Winds are pervasive and often strong and gusty.

2.2.3 Surface-Water Hydrology

The drainage on Sheppard AFB is controlled by open earthen and concrete-lined ditches, as well as underground storm drainage mains. Drainage from areas north of Missile Road is generally to the north, east, and southeast, whereas drainage from areas south of Missile Road is generally to the south and southeast. Drainage north of Missile Road converges with discharge from a wastewater treatment plant owned by Wichita Falls and then flows into Bear Creek near the base boundary (Figure 2-1).

In the northern portion of the base, the most significant drainage features are the storm ponding areas located west of Building 2320 and southwest of the Alert Apron. Bear Creek flows through the former prior to entering three 72-inch diameter underground pipes. Erosion is moderately developed in the area where storm drainage is heaviest. Vegetation (grasses and small trees) is abundant in both ponding areas.

A significant drainage feature in the southern portion of the base is the industrial waste line located along Avenue J. The industrial waste line is a closed discharge line for waste oil and fuel. Storm water, spilled oil, and fuel flows into open drains along the flight apron prior to entering the industrial waste line. The line leads to an oil/water separator and then discharges to a small pond at Site WP10.

Surface-water drainage leading off-base enters Bear Creek, North Side Canal, or Plum Creek. Drainage through the underground pipes or aqueducts in the northern portion of the base enters Bear Creek and flows approximately 5 miles to the Wichita River. Drainage in the southeastern portion of the base enters a tributary of North Side Canal, which is approximately 3 miles southeast of the base. Drainage in the southwestern portion of the base, along with discharges from the base wastewater treatment plant, flows into an unnamed creek, which ultimately empties into Plum Creek approximately 2.5 miles south of the base (Radian Corporation, 1986).

2.2.4 Geology

Sheppard AFB is located upon the eroded bedrock surface of the mid-Permian aged Petrolia Formation (Figure 2-2). Earlier studies refer to the bedrock as the Wichita Group (Engineering-Science, 1984; Radian Corporation, 1986). However, the stratigraphic nomenclature has since been revised, distinguishing the Petrolia Formation within the Wichita Group (Barnes, 1987). The Petrolia Formation covers much of Wichita and Clay counties in a broad band which strikes northeast-southwest. The entire area is characterized by essentially flat-lying sedimentary rocks, although some minor folding is reported northeast of Wichita Falls.

The Petrolia Formation consists primarily of mudstone with shale, siltstone, sandstone, and lesser amounts of conglomerate and limestone. The mudstone consists of crudely stratified, reddish brown silt and clay near the surface, grading to mottled brown and grayish-brown shale and siltstone with depth. Sandstone is common, with 10 mappable units (SS-1 through SS-10) distinguishable in the region. Sheppard AFB lies within the outcrop area of SS-7. The sandstone consists of brown and reddish brown, fine-to-medium grained, thick bedded to massive, cross-bedded, discontinuous lenses ranging in thickness from 3 to 25 feet. The total thickness of the Petrolia Formation ranges from 360 to 400 feet (Barnes, 1987).

At Sheppard AFB, the Petrolia is typically reddish-brown mudstone and siltstone that is extensively weathered to the depths explored (up to 60 feet) and contains significant sandstone beds. The siltstone and mudstone facies are generally massive and featureless other than weathering-induced mottling or occasional authigenic nodules.

Varying amounts of sand and sandstone were encountered in more than 75 percent of the borings drilled at Sheppard AFB. The sand and sandstone units were of reddish-brown, very light-brown, or blue-gray, fine-grained, moderately sorted, subround, thinly bedded, or occasionally cross-bedded, with silt or clay matrix and occasional glauconite. Sand thicknesses varied widely from less than 1 foot to 30 feet.

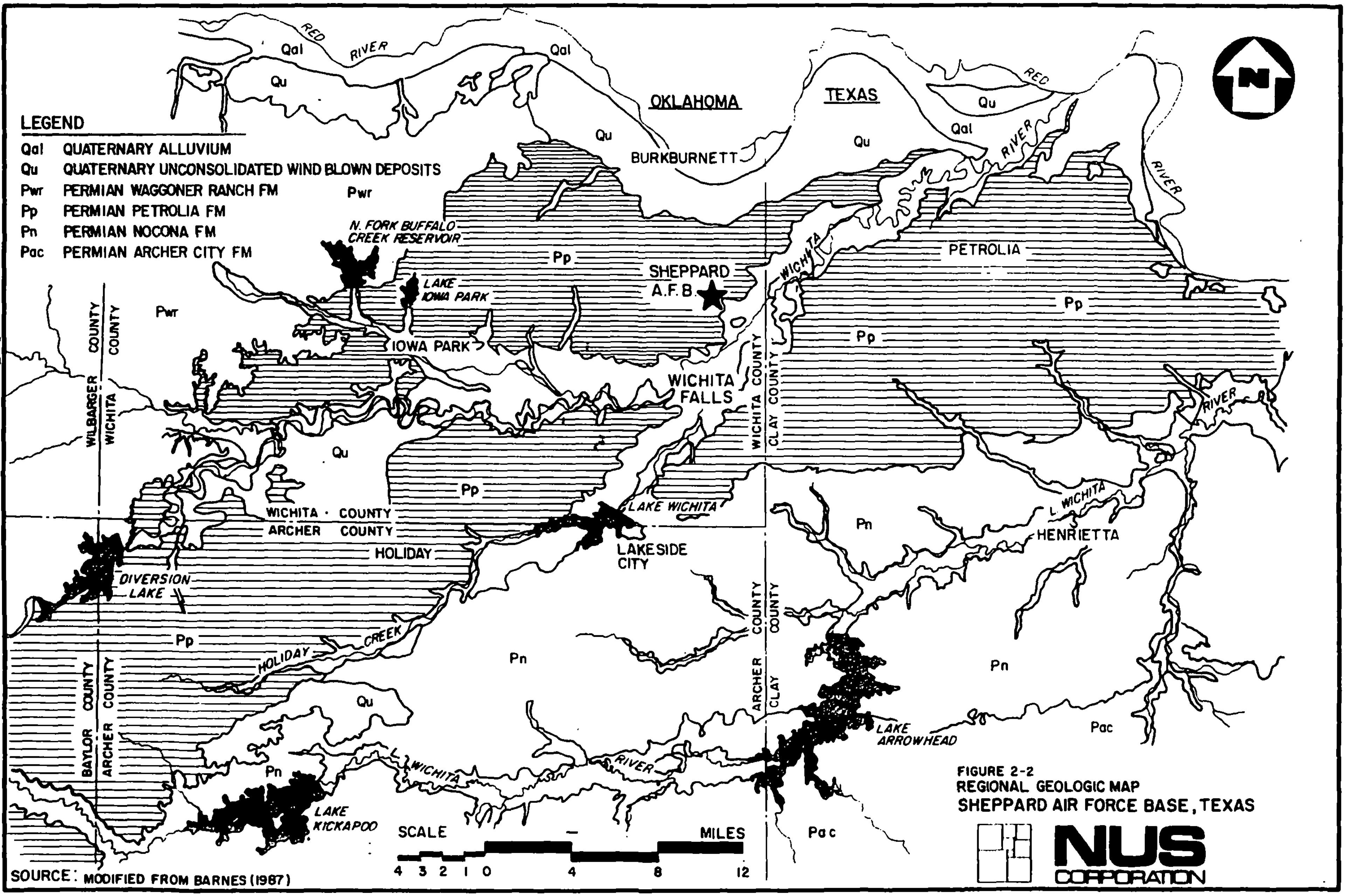

FIGURE 2-2
REGIONAL GEOLOGIC MAP
SHEPPARD AIR FORCE BASE, TEXAS

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The Petrolia Formation was deposited in a deltaic environment characterized by a mosaic of sands, silts, and muds. Siltstone and shale, the most commonly found lithologies at Sheppard AFB, apparently were deposited as prodelta silt and mud with the fine sand deposited at the delta front. However, the presence of occasional plant and vertebrate fossils within the Petrolia indicate the close proximity of terrestrial environments. The resulting stratigraphy is a series of discontinuous sand bodies within a unit dominated by siltstone and shale.

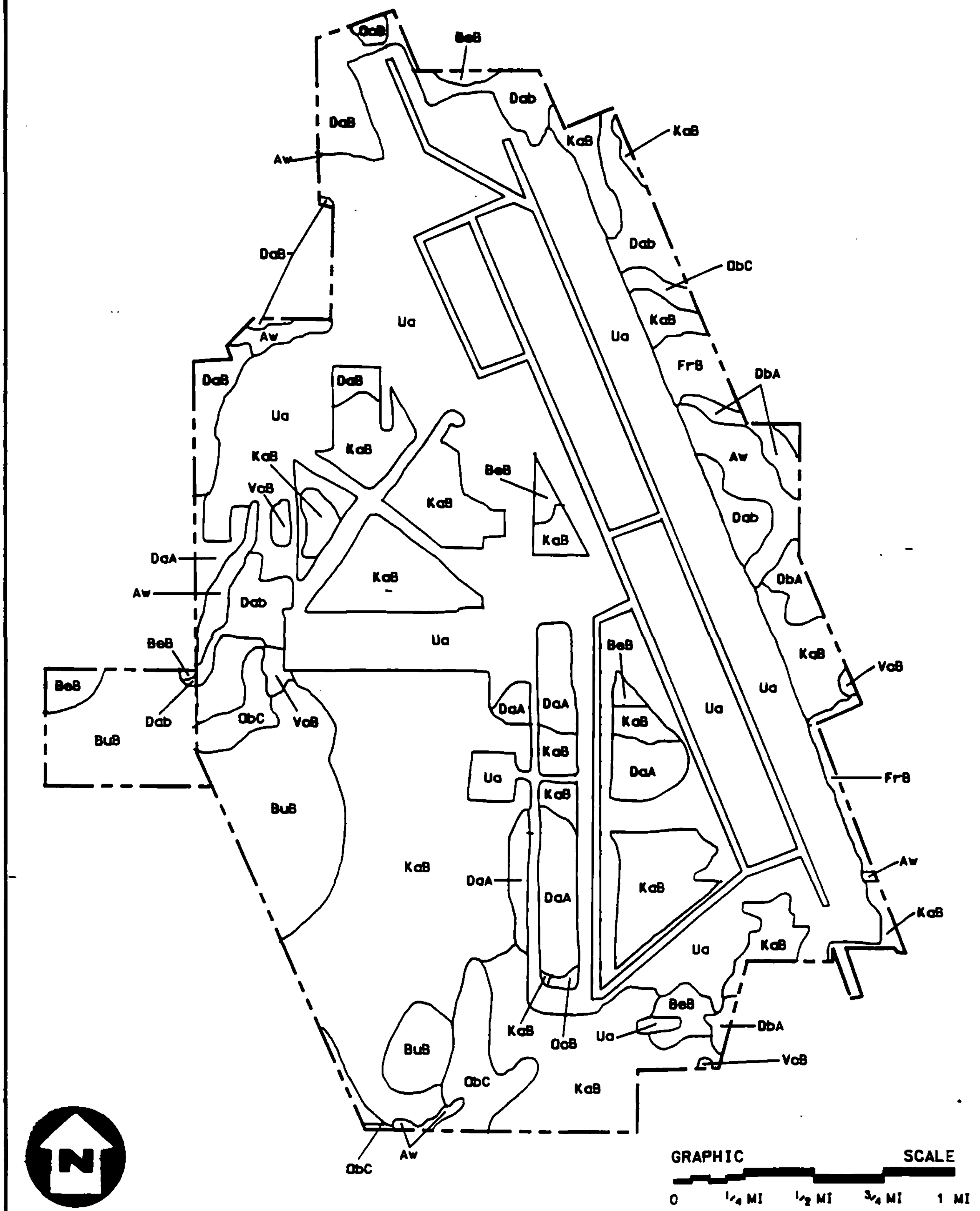
2.2.5 Soils

The soils of Sheppard AFB are typically sandy, silty, and clayey loam. Loam is a soil with varying proportions of sand, clay, and organic matter. Asa and Port soils are frequently flooded, whereas Oben fine sandy loam soils are susceptible to wind erosion. Figure 2-3 is a soils map for Sheppard AFB. The soil symbols shown on the map correspond to the soil descriptions and engineering properties as summarized in Table 2-1.

The soil property of concern for assessing the potential for surface water infiltration is vertical permeability. The vertical permeability values for soils on the base range from less than 4.2×10^{-5} centimeters per second (cm/sec) to 1.4×10^{-3} cm/sec (Richardson, et al., 1977), a fact which indicates that surface water infiltration is moderate to slow. The Soil Conservation Service (SCS) has ranked the basewide soils as having limited use for septic tank absorption fields. The SCS limitations are based on shallow depth to rock and slow percolation rates (Radian, 1986).

2.2.6 Hydrogeology

During the investigation, 22 monitoring wells (MWs) were installed at the base to monitor ground-water quality and to characterize ground-water flow. The data obtained during the investigation were augmented by information from nine monitoring wells installed during a previous investigation (Radian, 1986) and off-base wells identified in the Geological Investigation (USGS, 1988). The data were used to generate water-table contour maps illustrating the direction of ground-water flow in the shallow aquifer in the vicinity of Sheppard AFB.



SOURCE: RICHARDSON, W.E., et al. 1977

DRN. BY: ELLIOTT	NUS CORPORATION A Halliburton Company	FIGURE 2-3 GENERAL SOILS MAP
CKD. BY: J. WEDEKIND		CLIENT SHEPPARD AIR FORCE BASE
		SCALE AS SHOWN · DGN. NO. · REV. · SHEET 1 OF 1
		PROJ. NO. 7S63 · DATE

TABLE 2-1

SOIL DESCRIPTIONS AND ENGINEERING PROPERTIES SHEPPARD AIR FORCE BASE

Unit Abbreviation	Unit Description	Depth (inches)	Permeability (centimeters/second)	Septic Tank Absorption Field Use Limitation
Aw	Asa and Port soils, frequently flooded, silty clay loam	0-18 18-60	4.2×10^{-4} - 1.4×10^{-3} 4.2×10^{-4} - 1.4×10^{-3}	Severe[1]; floods
BeB	Bluegrove loam, 1 to 3 percent slopes	0-8 8-34 34-84	4.2×10^{-4} - 1.4×10^{-3} 1.4×10^{-4} - 4.2×10^{-4} (2)	Severe; depth to rock; percolation slow
BuB	Bluegrove - urban land complex. 1 to 3 percent slopes	0-8 8-34 34-84	4.2×10^{-4} - 1.4×10^{-3} 1.4×10^{-4} - 4.2×10^{-4} (2)	Severe; depth to rock; percolation slow
DeA	Deandale silt loam, 0 to 1 percent slopes	0-12 12-90	4.2×10^{-4} - 1.4×10^{-3} $<4.2 \times 10^{-4}$	Severe; percolation slow
DeB	Deandale silt loam, 1 to 3 percent slopes	0-12 12-90	4.2×10^{-4} - 1.4×10^{-3} $<4.2 \times 10^{-4}$	Severe; percolation slow
DbA	Deandale silt loam, loamy substratum, 0 to 1 percent slopes	0-8 8-74 74-88 88-100	4.2×10^{-4} - 1.4×10^{-3} $<4.2 \times 10^{-5}$ 4.2×10^{-4} - 4.2×10^{-4} 4.2×10^{-4} - 1.4×10^{-3}	Severe; percolation slow
FrB	Frankirk loam, 1 to 3 percent slopes	0-7 7-55	4.2×10^{-4} - 1.4×10^{-3} 1.4×10^{-4} - 4.2×10^{-4}	Severe; percolation slow
KaB	Kamay silt loam, 1 to 3 percent slopes	0-10 10-100	4.2×10^{-4} - 1.4×10^{-3} $<4.2 \times 10^{-5}$	Severe; percolation slow
KcB	Kamay - urban land complex, 0 to 3 percent slopes	0-10 10-100	4.2×10^{-4} - 1.4×10^{-3} $<4.2 \times 10^{-5}$	Severe; percolation slow

TABLE 2-1

SOIL DESCRIPTIONS AND ENGINEERING PROPERTIES
SHEPPARD AIR FORCE BASE
PAGE TWO

Unit Abbreviation	Unit Description	Depth (inches)	Permeability (centimeters/second)	Septic Tank Absorption Field Use Limitation
ObC	Oben fine, sandy loam, 1 to 5 percent slopes (3)	0-6 6-17 17-36	4.2×10^{-4} - 1.4×10^{-3} 4.2×10^{-4} - 1.4×10^{-3} (2)	Severe; depth to rock
Ua	Urban land		Too variable to be rated	
VcB	Vernon clay loam, 1 to 3 percent slopes	0-7 7-34 34-60	4.2×10^{-4} - 4.2×10^{-4} $<4.2 \times 10^{-5}$ $<4.2 \times 10^{-5}$	Severe; percolation slow

(1) Severe means that soils properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.
(2) No value; weakly cemented sandstone.
(3) Signs of wind erosion are present.

Source: Richardson, et al., 1977.

Ground-water resources in the shallow subsurface in the vicinity of Sheppard AFB are very limited because of the widespread occurrence of low-permeability materials (siltstone and clay) and the discontinuity of the sandstone units. Since ground-water resources are limited, they are not commonly used as a water supply for domestic use. Table 2-2 summarizes the major aquifers in the vicinity of Sheppard AFB. Most of these aquifers are used sparingly because of the highly mineralized water they produce. Water quality in the Quaternary alluvium and terrace deposits, however, is excellent, and wells completed within that shallow system produce water for public and municipal supply. There is no apparent subsurface hydrologic connection between the shallow ground water encountered in the residuum and bedrock at Sheppard and the alluvium and terrace deposits found nearby. Sheppard AFB obtains water from the City of Wichita Falls, which obtains its water supply from Lake Kemp and Lake Diversion.

Ground water was encountered in most drill holes around the base except at WP09 (drilled by Radian Corporation), FT02, and at a single location in both LF06 (SB-401) and LF05 (SB-203). Water was most prevalent in areas containing abundant sand, such as FT01, FT03, and ST13. However, ground water was also present within weathered siltstone and clay. Water in these low-permeability materials flows through fractures or relict bedding planes in the residual soil, resulting in limited quantities.

Water-level measurements indicate that ground-water at Sheppard generally follows surface topography and surface drainage patterns (Figure I-2, located in Appendix I). Ground water in the northern portion of the base flows northeastward toward the Bear Creek drainages and away from a topographic high near the base hospital. Ground water in the southern portion of the base flows both south and east towards the Wichita River. The Geological Investigation (GI) indicated that the local flow in the base vicinity is southerly as well.

Slug test data indicate that hydraulic conductivity is variable within the Petrolia Formation, depending on lithologic facies. Individual hydraulic conductivity values range from 1.51×10^{-3} cm/sec in sandstone at MW-801 to 1.12×10^{-5} cm/sec in clay and siltstone at MW-403. The average hydraulic conductivity calculated for wells completed in sandstone is 7.39×10^{-4} cm/sec, whereas the average hydraulic conductivity in the siltstone and clay facies is 4.13×10^{-5} cm/sec. The sandstone, while

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TABLE 2-2

HYDROGEOLOGIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS IN THE VICINITY OF SHEPPARD AIR FORCE BASE

System	Series	Group	Hydrogeologic Unit	Hydrogeologic Classification	Approximate Thickness (feet)	Dominant Lithology	Water-Bearing Characteristics
Quaternary	Recent to Pleistocene		Alluvium, wind-blown sand, and terrace deposits	Unconfined aquifers	80	Sand, silt, clay, and gravel.	Moderately transmits water; yields small to moderate amounts of water to wells along rivers and major tributaries.
			Seymour Formation	Unconfined aquifer	112	Sand, silt, clay, and gravel.	Moderately transmits water; yields small to moderate amounts of water to wells in the northwest corner of Wichita County.
Permian	Leonard	Clear Fork Group (undivided)		Unconfined aquifer	1,350	Dolomite, limestone, and shale.	Moderately transmits water; yields small to moderate amounts of water to wells in extreme northwest corner of Wichita County.
	Wolfcamp	Wichita Group[a] (undivided)		Unconfined and confined aquifers	670	Shale, sandstone, and limestone.	Moderately transmits water; yields small amounts of water, which is usually too highly mineralized for use.
Pennsylvanian	Upper	Cisco Group (undivided)		Unconfined and confined aquifers	1,000	Shale, sandstone, limestone, and conglomerate.	Moderately transmits water; yields small amounts of water, which is usually too highly mineralized for use.

(a) Includes Petrolia Formation.

Sources: USDA/SCS, 1977; Price, 1979; Baker, et al., 1963.

much more transmissive than the siltstone/clay facies, is poorly conductive for a sandstone unit. This is the result of the fine grain size and silty matrix found in the sandstone at Sheppard AFB.

Ground water occurs in confined and unconfined (water table) conditions. Water table conditions are found primarily in areas underlain by sand and sandstone extending from the surface (such as FT01, FT03, and WP10). Confined and semi-confined conditions are rather common across the base. Semi-confined ground water is found in areas of clayey silt or weathered shale in which no well-defined aquifer unit was identified. True confining conditions were found at MW301, MW302, and MW402 where 20-30 feet of clay overlaid a saturated sandstone unit. The static water level in the non-water table wells is about 10 feet below the ground surface.

Ground water at Sheppard AFB contains naturally-occurring concentrations of Total dissolved solids (TDS) and nitrate which often exceed drinking water standards. TDS exceeded 10,000 mg/L at four of six sites tested. Nitrate concentrations were six times the drinking water standard in the background well, and was found sporadically at other sites. Metals, such as arsenic and selenium, were rather common across the base and were apparently in part the result of natural conditions. Ground water which exceeds 10,000 mg/L TDS or contain natural concentrations of contaminants are termed Class III (EPA, 1988) as "Ground water not a potential source of drinking water and of limited beneficial use."

Ground water at Sheppard AFB was not observed to be in hydrologic connection with surface water at any site except FT01, where seeps were reported on the golf course (Radian,1986). Elsewhere, ground water is typically encountered below surface water sources, except at WP10 where the water levels in monitoring wells approximates the elevation of a small creek.

2.2.7 Ecology

Within the regional vicinity of Sheppard AFB, five species of animals have been listed as endangered by Federal or Texas agencies (Texas Parks and Wildlife Department, 1983). They are as follows:

- Black-footed ferret (weasel)
- Southern bald eagle

- Eskimo curlew
- Whooping crane
- Peregrine falcon

None of these species have been sighted in the vicinity of Sheppard AFB according to the Texas Parks and Wildlife Department (personal communication).

The Texas kangaroo rat, also found in the region, is listed as a threatened species by the U.S. Fish and Wildlife Service (Mapston, 1983). Kangaroo rats have been spotted in the vicinity of the Clara Oil Fields, located approximately 10 miles northwest of Sheppard AFB. There are no known endangered or threatened species on Sheppard AFB. The only permanent animal inhabitants of the base are various birds including quail, mourning doves, and owls, and small mammals such as squirrels and rabbits. Selected ponds on base have been stocked with bass, catfish, and sunfish (Engineering-Science, 1984), and turtles reside in the ponds as well.

3

3.0 SELECTED ABBREVIATIONS AND ACRONYMS

AFB	Air Force Base
ARAR	Applicable or Relevant and Appropriate Requirement
ATC	Air Training Command
AWQC	Ambient Water Quality Criteria
BB	Base Background
BCF	Bioconcentration Factors
BNA	Base Neutral/Acid Extractables
C	Corehole
CEC	Cation Exchange Capacity
cm/sec	Centimeters Per Second
CPF	Carcinogenic Potency Factor
DD	Decision Document
DOD	Department of Defense
DWEL	Drinking Water Exposure Level
EM	Electromagnetic
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FS	Feasibility Study
FTW	Flying Training Wing
FT01	Fire Protection Training Area, with Site Number
GC	Gas Chromatograph
HA	Health Advisories
HARM	Hazard Assessment Rating Method
HAZWRAP	Hazardous Waste Remedial Action Program
HI	Hazard Index
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
K	Kilogram

LF03	Landfill, with Site Number
ST13	Former Underground Storage Tank Site
mg/kg	Milligrams per Kilogram
MSL	Mean Sea Level
MW	Monitoring Well
NCTSPCS	North-Central Texas State Plane Coordinate System
NIPDWR	National Interim Primary Drinking Water Regulation
ND	Not Detected
OEHL	Occupational and Environmental Health Laboratory
OT11	Pesticide Spray Area, with Site Number
PAH	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
RI	Remedial Investigation
RW07	Low-Level Radioactive Waste Disposal Area, with Site Number
SB	Soil Boring
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SOV	Soil Organic Vapor
TCL	Target Compound List
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
µg/kg	Micrograms per Kilogram
USGS	United States Geological Survey
UST	Underground Storage Tank
VOA	Volatile Organic Aromatics
VOC	Volatile Organic Compound
WP	Work Plan
WP10	Waste Pit, with Site Number

4

4.0 REMEDIAL INVESTIGATION ACTIVITIES

4.1 GENERAL

This section summarizes the major RI activities at Sheppard AFB (Figure 4-1), which can be divided into three categories:

- Field investigation
- Laboratory analyses
- Risk assessment

The field investigation activities are discussed in Section 4.2. Laboratory analyses and rationale are discussed in Section 4.3. Risk assessment sections introducing terms and methodologies for determination of contaminant fate and transport (Section 4.4) and risk assessment (Section 4.5) are also presented.

More detailed rationale and scope of the RI activities performed for this project are detailed in the IRP Phase II - Confirmation/Quantification Stage I Report (Radian, 1986), the Final Work Plan (NUS, 1988) and a subsequent work plan addendum.

4.2 FIELD INVESTIGATION ACTIVITIES

Field investigation activities performed as part of the RI included geophysical investigations, soil gas surveys, soil borings, monitoring well installations, water-level measurements, aquifer testing, and soil and ground-water sampling. All field activities were conducted in accordance with the approved WP (NUS 1988, 1989) with regards to sampling protocols, documentation procedures, QA/QC, sample custody, etc. These activities are discussed in the following subsections.

4.2.1 Subsurface Investigation

A subsurface investigation was conducted at each site. A typical subsurface investigation consisted of soil borings, monitoring well installations, and soil and ground-water sampling. A test pit was hand excavated at Site RW07 to obtain subsurface information.

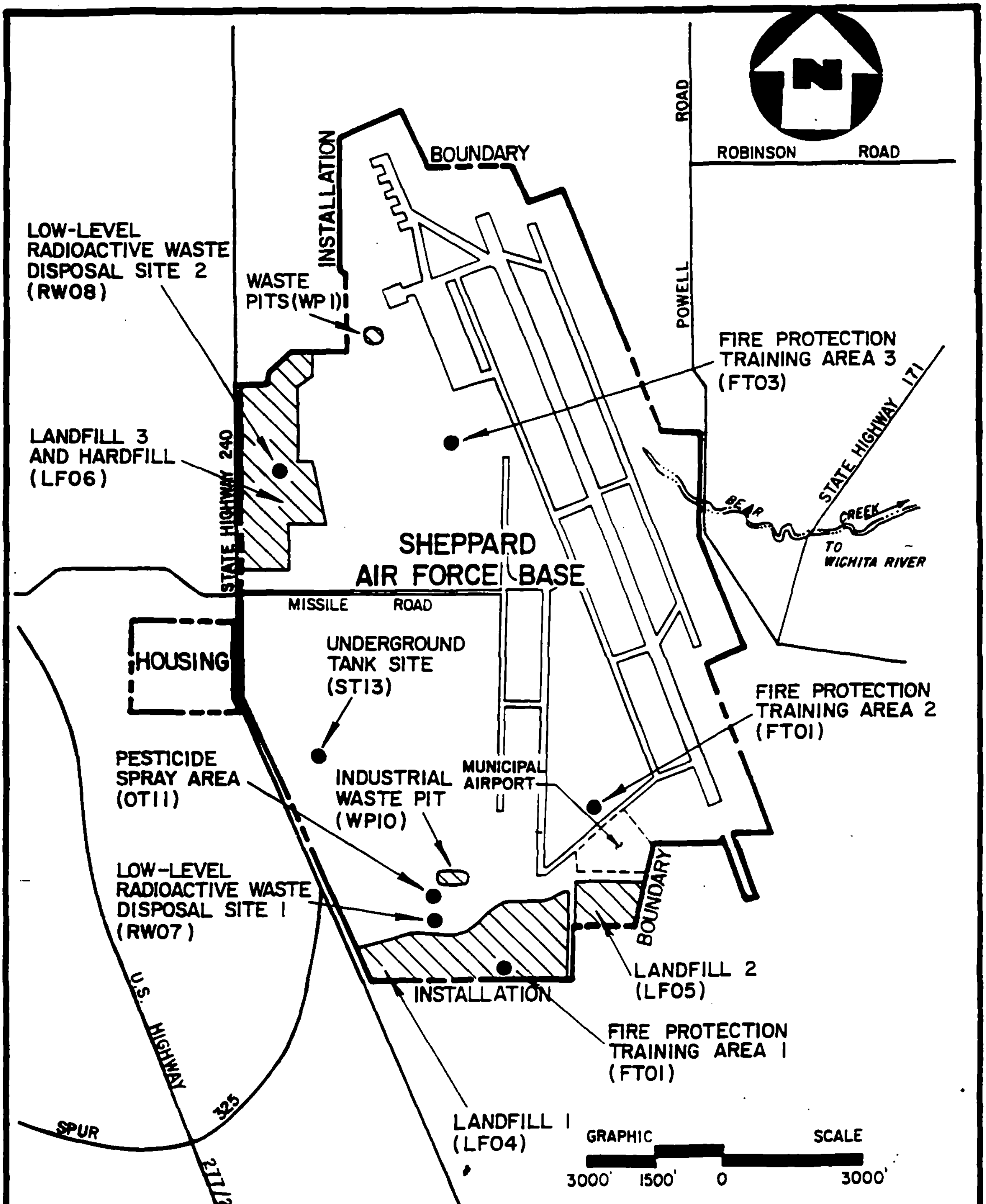

FIGURE 4-1
SITE LOCATION MAP
SHEPPARD AIR FORCE BASE

NUS CORPORATION

The borings drilled by the Radian Corporation in 1984-1985 were advanced using hollow-stem augers. Samples were obtained by driving split-spoon samplers or pushing Shelby tubes. This method proved marginally successful because of auger and sample refusal on shallow bedrock and difficulty penetrating weathered shale. Therefore, air rotary and coring techniques were used in the second phase of fieldwork conducted by NUS in 1988-1989. This method provided samples for accurate geologic interpretation of the subsurface material. In some instances, however, unconsolidated sands could not be cored successfully because either the material would be "washed out" by the compressed air or the core would not be retained in the core barrel upon extraction. Such caving formations were drilled using a tri-cone bit and sampled using a Shelby tube.

A total of 15 soil borings were drilled or hand excavated at the eleven sites during fieldwork by NUS and Radian Corporation. Upon completion of drilling, the boreholes were backfilled with grout and abandoned. Many borings were dry upon completion and were allowed to stand open for several days to several months prior to abandonment to determine whether water would accumulate in the open boreholes. Geologic logs for all borings are included in Appendix A.

A total of 31 monitoring wells were installed at Sheppard AFB during for the RI. Radian Corporation installed nine wells at three sites in 1985 and 1986. In 1988-1989, NUS installed 22 wells at nine sites. Table 4-1 summarizes the distribution of the 31 monitoring wells. One well was a temporary monitoring well, which was installed to obtain background levels of soil and ground-water chemistry. The temporary monitoring well (BB-01) was removed and abandoned after obtaining the necessary samples. Well construction details for all monitoring wells are given in Appendix B.

Generally, the depths of the borings and wells were established based on field observations and site-specific data requirements. Boring depths ranged from 25 feet at MW-803, where ground water was perched in a shallow sand, to 60 feet at MW-403 and MW-11, where no definite saturated zone was encountered.

Monitoring wells were installed with the screened interval designed to intersect the top of the saturated zone, whenever possible. However, ground water in most of the

R34892

TABLE 4-1

SUMMARY OF REMEDIAL INVESTIGATION ACTIVITIES
SHEPPARD AIR FORCE BASE

Site Number	Site Description	Geophysics			Drilling		Soil Gas Survey	Test Pits	Chemical Analytical Samples				
		Magnetometry	EMI	Resistivity	Monitoring Wells	Borings			Surface Soil (0-2 feet)	Subsurface Soil (>2 feet)	Sediment	Surface Water	Ground Water
01	Waste Pits (W09)(a)	No	Yes	Yes	0	5	No	0	0	18	0	1	0
02	Landfill 2 (LF05)	No	No	No	3	1	No	0	15	5	0	0	5
03	Landfill 1 (LF04)	No	No	No	3	0	Yes	0	7	3	1	1	5
04	Landfill 3 (LF06)(a)	Yes	Yes	Yes	4	3	No	0	2	9	2	8	7
05	Fire Protection Training Area 1 (FT01)(a)	No	Yes	Yes	7	4(b)	Yes	2	0	13	0	4	10
06	Fire Protection Training Area 2 (FT02)	No	No	No	0	5(b)	No	0	4	5	0	0	0
07	Fire Protection Training Area 3 (FT03)(a)	No	Yes	No	5	0	Yes	0	0	6	0	1	10
08	Industrial Waste Pit (WP10)	No	No	No	3	0	No	0	3	8	1	0	4
09	Pesticide Spray Area (OT11)	No	No	No	0	2(b)	No	0	2	2	0	0	0
10	Low-Level Radioactive Waste Disposal Site 1 (RW07)	No	No	No	0	0	No	1	0	0	0	0	0
11	Low-Level Radioactive Waste Disposal Site 2 (RW08)	Yes	No	No	1	0	No	0	0	1	0	0	2
12	Base Background (BB-01)	No	No	No	1	0	No	0	0	2	0	0	1
13	Former Underground Tank Site (ST13)	Yes	No	No	4	0	No	0	0	4	0	0	4
	TOTAL	**3**	**4**	**3**	**31**	**20**	**3**	**3**	**33**	**76**	**4**	**15**	**48**

(a) Sites which include data from Radian (1986) report.
(b) Includes shallow borings <5 feet in depth.

clayey lithologies flows through small seeps and fractures and, therefore, no true saturated zone exists. In these instances, screens were set to cross at any noticeable moist zone or fracture, and 15-foot screen lengths were often used to maximize the flow of water into the well. Depths to the top of the well screen varied from 4.5 feet at MW-501 to 42 feet at MW-303. The length and placement of the monitored (screened) interval at each well was determined in the field, based primarily on the following:

- The observed saturated thickness, depth, uniformity, and inferred ground-water yield of the water-bearing zone(s).

- The assumed vertical location of the contaminant source and its relation to the water-bearing horizon.

- The occurrence of an obvious water-bearing zone within otherwise impermeable material. Monitored intervals were generally made consistent, whenever possible, for wells installed within the same water-bearing zone at a given site.

4.2.2 Geophysical Investigations

Geophysical investigations were conducted at Sites FT01, FT03, LF06, RW08, and ST13. The Radian Corporation conducted geophysical investigations that utilized electromagnetics, resistivity, and magnetometry surveys at Sites FT01, FT03, and LF06. Details of Radian's geophysical efforts are presented in the Confirmation/Quantification Stage I Report (Radian, 1986).

NUS conducted a magnetometer survey at Site ST13 to determine the location of the underground storage tanks and a magnetometer survey at RW08 to help locate a possible disposal well. NUS personnel used a simultaneous-recording proton precession magnetometer/gradiometer, which provides data on both total magnetic field intensity and vertical magnetic gradient. Unfortunately, the presence of electrical and underground utilities at Site ST13 and scrap iron at RW08 caused significant interference and resulted in inconclusive data.

4.2.3 Soil Gas Surveys

Soil gas surveys were conducted at three sites at Sheppard AFB by an independent subcontractor (Target Environmental Services, Inc., Columbia, Maryland) to assist in delineation of the presence and extent of subsurface hydrocarbon contamination. The three sites surveyed included FT01, FT03, and LF04.

The presence of detectable levels of target analytes in the vadose zone is dependent on several factors, including the presence of vapor-phase hydrocarbons or dissolved or liquid concentrations adequate to facilitate volatilization into the saturated zone. The soil gas samples were collected from a 3- to 4-foot depth using a sampling probe inserted into a one-half inch hole produced using a slide hammer. Gas samples were analyzed for the presence of eight chlorinated hydrocarbons, benzene, toluene, ethylbenzene, xylenes, and methyl tert-butyl ether (MTBE).

The results of the surveys are summarized in the sections for Sites FT01, FT03, and LF04. The Target report is included in Appendix D.

4.2.4 Water-Level Measurements

Water levels were measured in all monitoring wells at the end of each field exercise. Water levels in the wells were obtained using either an electrical water-level indicator or "popper" attached to a 100-foot steel tape. The well tops were surveyed by licensed professional surveyors in order to obtain accurate horizontal coordinates and elevations above mean sea level. Horizontal coordinates were referenced to the Sheppard AFB Coordinate System and tied to the North-Central Texas State Plane Coordinate System, as described in Appendix C of the Work Plan (NUS, 1988). The water-level data were used to construct potentiometric surface maps for each site in addition to a basewide potentiometric map. Water levels were measured in all the existing monitoring wells (including the Radian wells) on January 17, 1989, then again on July 19-20, 1989. Water-level data are included in Appendix C of this document.

4.2.5 Aquifer Testing

All monitoring wells installed during the 1988 field effort were subject to slug tests to determine aquifer characteristics. Rising-head slug tests were performed using an automated pressure transducer and data logging system. Hydraulic conductivity values were calculated from the resulting data using the Bouwer and Rice (1976) methodology. The aquifer test results and calculations are included in Appendix C.

4.2.6 Ground-Water Sampling

Upon installation, each monitoring well was developed, purged, and subsequently sampled. Well development and purging was performed using a decontaminated stainless-steel bailer. Purging involved either the removal of three well-volumes of water or bailing to dryness and allowing the well to recharge for 24 hours before sampling. Monitoring wells were sampled using dedicated, stainless-steel, bottom-loading bailers within 24 hours of purging. The samples were properly labeled, packaged, and shipped for laboratory analyses in accordance with procedures specified in the September 1988 Work Plan.

4.2.7 Surface-Soil Sampling

Surface-soil samples were collected at Sites LF04, LF05, LF06, FT02, WP10, and OT11 to determine whether surface-soil contamination was present. The sampling locations are discussed in Sections 6.0 through 16.0. Sites LF04, LF05, and WP10 required additional sampling in response to suspected contamination discovered in the 1988 phase of the field investigation. Surface-soil samples were collected in accordance with procedures outlined in the September 1988 Work Plan.

4.2.8 Surface-Water/Sediment Sampling

Surface-water and sediment samples were collected at Sites LF04 and LF06. These samples were to determine if contamination leaching or eroded from the landfills had entered the surface water bodies which are present within those sites. The specific sampling locations are discussed in Sections 9.0 and 11.0. The sampling was conducted in accordance with procedures outlined in the September 1988 Work Plan.

4.2.9 Subsurface-Soil Sampling

Subsurface-soil samples were collected during the installation of all soil borings and monitoring wells to determine subsurface stratigraphy and the presence of subsurface soil contamination. Samples were collected at 5-foot intervals using a split-spoon sampler. Each sample was visually classified and field-screened with a photoionization detector to monitor for the presence of volatile organic compounds. The site geologist determined which samples were sent to the laboratory for chemical analysis based on site observations or the field screening results. More detailed sampling methodology is outlined in the Work Plan (NUS, 1988).

4.3 LABORATORY ANALYSES

The field investigation included collection of surface soil, subsurface soil, sediment, surface water, and ground-water samples. The samples were analyzed for a variety of chemical parameters, based on the anticipated range of wastes that may have been disposed, spilled, or burned at Sheppard AFB. The following groups of analytical parameters were used to assess the presence of contamination in soils, ground water, surface water, and sediments at Sheppard AFB:

Analytical Category	Basis for Selection
Volatile Organics, TCL	Widespread use of organic solvents in equipment maintenance. Aromatic volatiles are present in fuels.
Priority Pollutant Metals and Cyanide	Possible disposal of metal and cyanide-bearing wastes and sludges. Heavy metals are found in many paints. Records search revealed silver, cadmium, chromium, mercury, copper, and other metal wastes are generated on site.
Base Neutral/Acid Extractables	Possible disposal and burning of high-molecular-weight organic wastes containing polycyclic aromatic hydrocarbons, phthalate esters, and phenolics.
PCBs and Pesticides	PCBs are often found in waste oils, which may have been disposed or burned at the site. A pesticide rinsate disposal area exists on site. Additional pesticide analyses were performed after chromatograms indicative of pesticides were encountered during validation of laboratory reported PCB data from a few sites other than the pesticide spray area.
Common Anions, Total Dissolved Solids	Typical constituents of landfill leachates, which serve as indicators of leachate migration.
Cation Exchange Capacity	Used to determine capability of soils to attenuate contamination (i.e., heavy metals).
Radiological Parameters	Two radiological disposal sites exist at Sheppard AFB.

Many of these groups contain chemicals that are mobile in ground water (e.g., volatiles and phenolics). Other groups, such as the base neutral/acid extractables (BNAs) and polychlorinated biphenyls (PCBs), are less mobile; however, most are essentially persistent in the environment. Therefore, if chemicals belonging to these groups were disposed of at these sites, there should be sufficient residual contamination in soils and ground water to allow detection with the analytical methods used.

Round I environmental samples were analyzed by metaTRACE Inc. (metaTRACE) of Earth City, Missouri. Data validation was conducted by NUS chemists located in Pittsburgh, Pennsylvania. Concerns over metaTRACE's responsiveness, and inconsistencies in the data packages, resulted in their removal as an IRP approved laboratory by HAZWRAP. Therefore, the Round II samples were analyzed by NUS Laboratory Services Group, also located in Pittsburgh.

Details of laboratory QA/QC is given in Appendix F. The validated analytical data base is presented in Appendix G.

4.4 CONTAMINANT FATE AND TRANSPORT

Assessing the public heath and environmental risks requires considering contaminant fate and transport in soils and ground waters. Release of contaminants with toxic characteristics by either natural processes or human action, contaminant migration, and the persistence of contaminants are all important aspects of contaminant fate and transport, which must be considered in a risk assessment.

Properties such as contaminant solubility and vapor pressure indicate a contaminant's ability to volatilize, whereas specific gravity and soil/sediment adsorption coefficients indicate the tendency of a contaminant to sink or float in water and/or to bind to soil particles containing organic carbon, respectively. The octanol/water portion coefficient is used to estimate a contaminant's tendency to bioconcentrate in fatty tissues of animals and humans.

Human activities (e.g., the disturbance of soils during construction) as well as natural processes (e.g., erosion) contribute to contaminant migration. Additionally, a contaminant's physical/chemical properties and the natural environment determine biodegradation rates.

All of these properties and processes effect the fate and transport of contaminants in soils and ground water, as discussed in detail in the following sections.

Properties that effect contaminant migration are presented in Section 4.4.1. Section 4.4.2 identifies potential contaminant migration routes, and contaminant persistence is discussed in Section 4.4.3.

4.4.1 Chemical and Physical Properties of Site Contaminants

Various chemical and physical properties of the contaminants detected at Sheppard AFB are presented and discussed in this section. These properties are used to estimate the environmental behavior of the chemical contaminants.

Physical and chemical properties of the organic contaminants found at the Base are presented in Table 4-2. Empirically determined, published values of specific gravity, vapor pressure, water solubility, the Henry's Law constant, octanol/water partition coefficient, the soil/sediment adsorption coefficient, and bioconcentration factors for the majority of organic contaminants detected are presented, when available. A discussion of the environmental significance of each of these parameters follows:

- Specific gravity is the ratio of the weight of a given volume of pure chemical, at a specified temperature, to the weight of the same volume of water at a given temperature. Its primary use is to determine whether a contaminant will have a tendency to float or sink in water if it is present as a pure compound or at very high concentrations. Contaminants with a specific gravity less than 1 will tend to float.

- Vapor pressure provides an indication of the rate at which a chemical volatilizes from both soil and water. It is of primary significance at environmental interfaces such as between surface soil and air or between surface water and air and is not as significant when evaluating contaminated ground water and subsurface soils. Chemicals with higher vapor pressures (monocyclic aromatics and halogenated aliphatics) are expected to enter the atmosphere much more readily than chemicals with lower vapor pressures (phthalate esters, polynuclear aromatic hydrocarbons

R34892

TABLE 4-2
MOBILITY PARAMETERS FOR ORGANIC CHEMICALS
SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
PAGE TWO

CAS Number	Chemical	Molecular Weight(1)	Specific Gravity(2) (20/4°C)(3)	Vapor Pressure @ 20°C(1) (mm Hg)	Water Solubility @ 20°C(1) (mg/l)	Octanol/Water Partition Coefficient(1)	Soil/Sediment Adsorption(1) Coefficient	Henry's Law Constant(1) (atm-m^3/mole)	Bioconcentration Factor(1) (µg/kg) $(\mu g/l)^{-1}$(4)
PESTICIDES/PCBs									
319-85-7	Beta-BHC	291	NA	2.8×10^{-7}	0.24 (25°C)	7,800	3,800	4.5×10^{-7}	1,500
58-89-9	Gamma-BHC	291	1.87	1.6×10^{-4}	7.8 (25°C)	7,800	3,800	7.8×10^{-6}	1,500
57-74-9	Chlordane	409.8	NA	1×10^{-5} (25°C)	0.056 (25°C)	300,000	140,000	9.4×10^{-5}	40,000
60-57-1	Dieldrin	381	NA	1.78×10^{-7}	0.195 (25°C)	3,500	1,700	4.57×10^{-10}	710
1024-57-3	Heptachlor epoxide	389.2	NA	3.0×10^{-4} (25°C)	0.350 (25°C)	450	220	3.9×10^{-4}	110
72-55-9	DDE	318	NA	6.5×10^{-6}	0.040	9.1×10^{-6}	4.4×10^{-6}	6.8×10^{-5}	8.9×10^{5}
74-54-8	DDD	320	NA	10.2×10^{-7}	0.09 (25°C)	1.6×10^{-6}	7.7×10^{-5}	2.2×10^{-8}	1.8×10^{5}
50-29-3	DDT	354.5	NA	1.9×10^{-7}	5.5×10^{-3} (25°C)	8.1×10^{-6}	3.9×10^{-6}	1.58×10^{-5}	8.0×10^{6}
319-86-8	D-BHC	291	1.87	1.7×10^{-5}	31.4 (24°C)	1.4×10^{-4}	6.6×10^{-3}	2.07×10^{-7}	3.5×10^{3}
76-44-8	Heptachlor	373.5	1.57	3×10^{-4} (25°C)(2)	0.18 (25°C)	2.6×10^{-4}	1.2×10^{-4}	4.0×10^{-3}	4.4×10^{3}

NA Not Available
(1) USEPA, December 1982.
(2) Verschueren, K., 1983.
(3) Refers to 20°C for the compound and 4°C for water.
(4) Units are (µg/kg)/(µg/l) as BCF is the ratio of aquatic-animal-tissue concentration to water concentration.

R34892

TABLE 4-2

MOBILITY PARAMETERS FOR ORGANIC CHEMICALS
SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS

CAS Number	Chemical	Molecular Weight[1]	Specific Gravity[2] (20/4°C)[3]	Vapor Pressure @ 20°C[1] (mm Hg)	Water Solubility @ 20°C[1] (mg/l)	Octanol/Water Partition Coefficient[1]	Soil/Sediment Adsorption[1] Coefficient	Henry's Law Constant[1] (atm-m³/mole)	Bioconcentration Factor[1] (µg/kg) (µg/l)$^{-1}$[4]
MONOCYCLIC AROMATICS									
71-43-2	Benzene	78.11[2]	0.879	76[2]	1,780[2]	135	65	5.55×10^{-3}	37
108-88-3	Toluene	92.1[2]	0.867	22[2]	515[2]	620	300	6.66×10^{-3}	148
HALOGENATED ALIPHATICS									
79-34-5	1,1,2,2-Tetrachloroethane	167.86[2]	1.60	5[2]	2,900[2]	245	118	3.81×10^{-4}	91
79-01-6	Trichloroethene	131.5[2]	1.46	60[2]	1,100 (25°C)	263	126	9.1×10^{-3}	97
67-66-3	Chloroform	119.38[2]	1.489	150.5	8,200	91	44	2.88×10^{-3}	26
PHTHALATE ESTERS									
117-81-7	Bis(2-ethylhexyl)phthalate	391	0.99 (20/20°C)	2×10^{-7}	0.285 (24°C)[2]	4.1×10^{9}	2.0×10^{9}	3×10^{-7}	2.3×10^{8}
117-84-0	Di-n-octyl phthalate	391	0.99 (20/20°C)	1.4×10^{-4} (25°C)	3.0 (25°C)	7.4×10^{9}	3.6×10^{9}	1.7×10^{-5}	3.9×10^{8}
POLYNUCLEAR AROMATIC HYDROCARBONS									
205-99-2	Benzo(b)fluoranthrene	252.3	NA	5×10^{-7}	0.014 (25°C)	1.15×10^{6}	550,000	1.22×10^{-5}	140,000
50-32-8	Benzo(a)pyrene	252	NA	5.6×10^{-9} (25°C)	3.8×10^{-3} (25°C)	1.15×10^{6}	5.5×10^{6}	4.9×10^{-7}	140,000
206-44-0	Fluoranthene	202.3	NA	5.0×10^{-6} (25°C)	0.26 (25°C)	79,000	38,000	6.5×10^{-6}	12,000
85-01-6	Phenanthrene	178.2[2]	1.025	9.6×10^{-4} (25°C)	1.0 (25°C)	28,000	14,000	2.26×10^{-4}	4,700
129-00-0	Pyrene	202.3	NA	2.5×10^{-6} (25°C)	0.13 (25°C)	80,000	38,000	5.1×10^{-6}	12,000

[PAHs], and pesticide/PCBs). Highly volatile compounds readily migrate from water and surface soils, potentially resulting in airborne contaminant levels that are a public health concern.

- Water solubility is directly proportional to the rate at which a chemical is leached from a waste deposit by infiltrating precipitation. More soluble chemicals are more readily leached than less soluble chemicals. The water solubilities presented in Table 4-2 indicate that the volatile organic chemicals (monocyclic aromatics and halogenated aliphatics) are usually several orders of magnitude more water soluble than the base/neutral compounds (phthalate esters and PAHs) and pesticide/PCBs.

- Both the vapor pressure and the water solubility are used in determining volatilization rates in surface waters and ground waters. The ratio of these two parameters is the compound's Henry's Law constant, which is used to calculate the equilibrium contaminant concentrations in the vapor (air) versus the liquid (water) phases for the dilute solutions commonly encountered in environmental sampling. In general, compounds having a Henry's Law constant less than 5×10^{-6} atm-m^3/mole should volatilize very slowly and compounds having a Henry's Law constant greater than 5×10^{-3} atm-m^3/mole will volatilize rapidly (Dragun, 1988).

- The octanol/water partition coefficient (K_{ow}) is a measure of the equilibrium partitioning of chemicals between octanol and water. A linear relationship between the octanol/water partition coefficient and the uptake of chemicals by fatty tissues of animal and human receptors (the bioconcentration factor) has been determined (Lyman, et al., 1982). The K_{ow} is also useful in characterizing the sorption of compounds by organic soils where experimental values are not available. PAHs, phthalate esters, and pesticides/PCBs are several orders of magnitude more likely to partition to fatty tissues than the more soluble volatile organics. The octanol/water partition coefficient is also used to estimate bioconcentration factors in aquatic organisms.

- The soil/sediment adsorption coefficient indicates the tendency of a chemical to bind to soil particles containing organic carbon. Chemicals with high soil/sediment adsorption coefficients generally have low water solubilities and vice versa. This parameter may be used to infer the relative rates at which the more mobile chemicals (monocyclic aromatics and halogenated aliphatics) are transported in the ground water. Chemicals such as phthalate esters and PAHs are relatively immobile in the environment and are preferentially bound to the soil phase. These compounds are not subject to ground-water transport to the extent that compounds with higher water solubilities are. However, these immobile chemicals are easily transported by erosional processes if they are present in surface soils.

- Bioconcentration is defined as the uptake of chemicals by animal, human, and aquatic organisms. Bioconcentration factors (BCF) represent the ratio of aquatic-animal-tissue concentration to water concentration. The ratio is both contaminant- and species-specific. Many of the phthalate esters, PAHs, and pesticides will bioconcentrate at levels 3 to 6 orders of magnitude greater than those concentrations found in the water, whereas volatile organics are not as readily bioconcentrated.

The distribution of organic chemicals in the environmental media sampled during the field investigation is governed primarily by source loading and by the physical and chemical properties listed above. However, human intervention also plays a role in contaminant migration, as discussed in the following section.

4.4.2 Contaminant Migration Pathways

The following contaminant release mechanisms and migration pathways are potentially in operation at Sheppard AFB.

- Contaminant desorption from soils and the subsequent transport via the ground water. Given the infrequent subsurface soil and sporadic ground-water contamination detected at Sheppard AFB, this is not a significant migration pathway, even at sites demonstrating elevated organic/inorganic soil contamination.

- Erosion of contaminants in surface soils via rain water run-off and subsequent transport via surface water. Given the infrequent surface soil and surface water contamination detected at Sheppard AFB, this is not a significant contaminant migration pathway. Additionally, exposures to contaminants in the surface waters of the drainage system and creek are of little concern due to the nature, use, and location of these surface water bodies.

- Transport of surface soil contaminants via wind erosion. Given the infrequent surface soil contamination detected at Sheppard AFB, this is not predicted to be a significant migration pathway.

These mechanisms were identified through an evaluation of the site data base and known site characteristics. The transfer of pesticide contaminants from surface soils to the subsurface during drilling operations is also a potential release or distribution mechanism. Such a mechanism may explain the occurrence of pesticides, which exhibit low solubilities, in several of the ground-water samples collected from Site WP10.

4.4.3 Contaminant Persistence

Contaminant persistence is a term used to describe the "staying power" of a contaminant. Persistent contaminants are those that are not readily transformed in the environment. Transformation mechanisms include hydrolysis, biodegradation, photolysis, and oxidation/reduction reactions.

The persistence of various classes of site contaminants is discussed in this section. The following general classes of compounds are discussed:

- Monocyclic aromatic compounds
- Phthalate esters
- Polynuclear aromatic hydrocarbons (PAHs)
- Pesticides/Polychlorinated biphenyls (PCBs)

?

Monocyclic aromatic compounds such as benzene and toluene are not considered to be persistent environmental contaminants in comparison to PCBs and PAHs. Such compounds are subject to degradation via the action of both soil and aquatic microorganisms. The biodegradation of these compounds in the soil matrix is dependent on the abundance of microflora, macronutrient availability, soil reaction (pH), temperature, water, and oxygen.

Although monocyclic aromatic compounds are amenable to microbial degradation, degradation will occur at an appreciable rate only when macronutrient (e.g., nitrate) levels are not a limiting factor. If these contaminants discharge to a surface-water body, biodegradation may occur relatively rapidly. For example, a reported first-order biodegradation rate constant for benzene is 0.11 day^{-1}[(a)] in aquatic systems (Lyman, et al., 1982). This corresponds to an aquatic half-life of approximately 6 days. Other monocyclic aromatics are subject to similar degradation processes in aquatic environments. (EPA, December 1982). Additional environmental degradation processes, such as hydrolysis and photolysis, are considered to be insignificant fate mechanisms for monocyclic aromatics (EPA, December 1982).

Phthalate esters are considered to be relatively persistent environmental contaminants. Although numerous studies have demonstrated that phthalate esters undergo biodegradation, it appears that this is a very slow process in both soils and surface waters. Consequently, biodegradation of phthalate esters is an important fate mechanism over the long-term. Bis(2-ethylhexyl)phthalate is considered to be the least degradable phthalate ester (EPA, December 1979). Hydrolysis is not expected to be a significant degradation mechanism for phthalate esters. For example, a reported alkaline hydrolysis half-life for bis(2-ethylhexyl)phthalate in aquatic systems is 2,000 years (EPA, December 1979). Similarly, photolysis is considered to be an insignificant degradation mechanism (EPA, December 1982).

PAHs are common constituents of oil and grease. Landfarming applications have indicated that PAHs are amenable to microbial degradation. Studies have demonstrated that PAHs are much more amenable to degradation in soil matrices than in aquatic environments (EPA, December 1979). Microbial degradation is expected to be insignificant when nutrient availability and microbial populations are quite low. PAHs do not contain functional groups susceptible to hydrolytic actions. Therefore, hydrolysis is considered an insignificant degradation mechanism. Photolysis can be a major degradation factor in aquatic environments but, due to the nature of the process, is generally insignificant in surface soils.

(a) A first-order reaction is a process in which the rate of a reaction is proportional to the amount of the chemical present.

When pesticides and herbicides are used, significant levels may reach soils or sediments where they are strongly adsorbed. Bioconcentration of pesticides in the food chain is an important fate mechanism. Hydrolysis, oxidation, and photolysis are not generally important fate mechanisms for pesticides in soil or water. A hydrolysis half-life of 4 years was reported for chlordane in water (EPA, December 1979). Volatilization may be an additional loss process for chlordane, dieldrin, and other pesticides.

4.5 RISK ASSESSMENT

This section presents the public health and environmental risk assessment for Sheppard AFB based on the results of the site investigations conducted to date. The objective of this assessment is to define the actual or potential risks to human health and the environment from the presence of hazardous materials on and around each site.

Three major aspects of chemical contamination and environmental fate and transport must be considered to assess public health and environmental risks,: (1) contaminants with toxic characteristics must be found in environmental media and be released by either natural processes or human action; (2) pathways by which actual or potential exposures occur must be present; and (3) human or environmental receptors must be present to complete the exposure route. Risk is a function of both toxicity and exposure; without all of the factors listed above, there is no risk.

This risk assessment estimates the potential for human health and environmental risks at the sites by combining information on the toxicity of the compounds detected in the environmental media with a site-specific estimate of exposure probability. According to current EPA Guidance (April 1988), the risk assessment is presented in four sections:

- Hazard Assessment
- Dose-Response Evaluation
- Exposure Assessment
- Risk Characterization, according to current EPA guidance (April 1988).

4.5.1 Hazard Assessment

The Hazard Assessment is made up of two parts:

- Hazard identification
- Toxicological evaluation

The hazard identification (Section 4.5.1.1) is primarily concerned with the selection of chemical contaminants (indicator chemicals) that are representative of the type and magnitude of potential human health and/or environmental effects. Contaminant concentrations, contaminant release and environmental transport mechanisms, exposure routes, and toxicity are considered to develop a list of contaminants that adequately defines the site-associated risks.

4.5.1.1 Hazard Identification

This section is concerned with the selection of a list of chemicals (indicator chemicals) that will adequately characterize the carcinogenic and noncarcinogenic risks to potential receptors as a result of exposure to contaminant levels in the environmental media at Sheppard AFB. Indicator chemicals selected for the RI are presented in Table 4-3. The rationale for inclusion or deletion of specific site contaminants is presented in the following paragraphs. The nature and extent of contamination at Sheppard AFB is presented on a site-by-site basis in Sections 5.0 through 16.0 of this document. These sections and Appendix G (Analytical Data Base) should be reviewed as necessary. A number of Target Compound List (TCL) organic and Priority Pollutant List inorganic chemicals were detected during the investigations.

Several pesticides, listed on Table 4-3, were frequently detected at the study sites. Because a majority of the pesticides are suspected human carcinogens and are often persistent in the environment, they were selected as indicator chemicals even though past pesticide application practices may be responsible for much of the pesticide contamination detected. The pesticides appear to have been used throughout the base for insect control.

Volatile organic compounds (VOCs) and base neutral/acid extractables (BNAs) were infrequently detected and/or detected at low concentrations, only, in the environmental media sampled at Sheppard AFB. Consequently, these compounds

TABLE 4-3

INDICATOR CHEMICALS
SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS

Known or Probable Carcinogens	Noncarcinogens
alpha-Hexachlorocyclohexane	delta-Hexachlorocyclohexane
beta-Hexachlorocyclohexane	
Heptachlor[a]	
Heptachlor epoxide[a]	
4,4'-DDD	
4,4'-DDE	
4,4'-DDT	
Dieldrin[a]	
alpha-Chlordane[a]	
gamma-Chlordane[a]	

(a) Chemical also has noncarcinogenic health effects.

are not considered significant indicator compounds for Sheppard AFB. The site-specific risk assessments presented in Sections 5.0 through 16.0 evaluate contaminants such as benzene, a Class A carcinogen, which were infrequently detected in site ground water at concentrations approaching current Federal Safe Drinking Water Act (SDWA) primary maximum contaminant levels (PMCLs).

The following inorganics were infrequently detected in site surface soils, surface water, or ground waters at concentrations exceeding base or regional background levels or current Federal PMCLs:

- Antimony
- Arsenic
- Chromium
- Nickel
- Zinc
- Lead
- Fluorides
- Nitrates

Consequently, these inorganics are selected as indicator compounds for the risk assessment conducted for Sheppard AFB.

4.5.1.2 Toxicological Evaluation

The available toxicological information indicates that many of the indicator chemicals have both noncarcinogenic and carcinogenic health effects in humans and/or in experimental animals. Although the indicator chemicals may cause adverse health and environmental impacts, dose-response relationships and the potential for exposure must be evaluated before the risks to receptors can be determined. Dose-response relationships correlate the magnitude of the dose with the probability of toxic effects, as discussed in the following section.

4.5.2 Dose-Response Evaluation

This section presents available human health and environmental standards and criteria as well as dose response parameters for the site indicator compounds.

4.5.2.1 Dose-Response Parameters

An important component of the risk assessment process is the relationship between the dose of a compound (amount to which an individual or population is exposed) and the potential for adverse health effects resulting from exposure to that dose. Dose-response relationships provide a means by which potential public health impacts may be evaluated. The published information on doses and responses is used, in conjunction with information on the nature and magnitude of human exposure, to develop an estimate of health risks.

Standard reference doses (RfDs) and/or carcinogenic potency factors (CPFs) have been developed for many of the compounds on the TCL. Applicable RfDs and CPFs have been obtained from the EPAs Integrated Risk Information System (IRIS) Computer Data Base (EPA, June 1989). This section provides a brief description of these parameters. The dose-response parameters for indicator chemicals are summarized in Table 4-4.

Reference Dose (RfD) - The RfD is developed by EPA for chronic and/or subchronic human exposure to hazardous chemicals and is based solely on the noncarcinogenic effects of chemical substances. The RfD is usually expressed as a dose (mg) per unit body weight (kg) per unit time (day). It is generally derived by dividing a no-observed-(adverse)-effect-level (NOAEL or NOEL) or a lowest observed-adverse-effect-level (LOAEL) by an appropriate "uncertainty factor." NOAELs, etc., are determined from laboratory or epidemiological toxicity studies. The uncertainty factor is based on the availability of toxicity data.

A factor of 10 is used when a reference dose is extrapolated from valid experimental results of chronic human exposure to a chemical, a fact which accounts for individual variations in sensitivity. A factor of 100 is used when it is necessary to extrapolate from long-term studies on experimental animals or when the results from human exposure are not available or are inadequate. This accounts for the uncertainties involved in extrapolating from animals to humans. A factor of 1,000 is used when

TABLE 4-4

DOSE-RESPONSE PARAMETERS FOR INDICATOR CHEMICALS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Compound	CPF $(mg/kg\text{-}day)^{-1}$	RfD (mg/kg-day)
alpha-BHC	6.3	NA[a]
beta-BHC	1.8	NA
Heptachlor	4.5	$5x10^{-4}$
Heptachlor epoxide	9.1	$1.3x10^{-5}$
4,4'-DDD	$2.4x10^{-1}$	NA
4,4'-DDE	$3.4x10^{-1}$	NA
4,4'-DDT	$3.4x10^{-1}$	$5x10^{-4}$
Dieldrin	16	$5x10^{-5}$
Chlordane	1.3	$6x10^{-5}$

(a) NA - indicates information not available.

extrapolating from subchronic exposures of experimental animals when no human data are available. Finally, a factor of 10,000 is used when it is necessary to derive an RfD from an LOAEL instead of an NOAEL. Professional judgment can also be used to incorporate an additional modifying factor of up to 10, depending on other uncertainties in the data base not covered by an uncertainty factor, such as completeness or number of species tested.

Thus, the RfD incorporates the surety of the evidence for chronic human health effects. Even if applicable human data exist, the RfD (as diminished by the uncertainty factor) still maintains a margin of safety so that chronic human health effects are not underestimated. Thus, the RfD is an acceptable guideline for evaluation of noncarcinogenic risk, although the associated uncertainties preclude its use for precise risk quantitation.

Carcinogenic Potency Factor (CPF) - CPFs are applicable for estimating the lifetime probability (assumed 70-year lifespan) of human receptors contracting cancer as a result of exposure to known or suspected carcinogens. This factor is generally reported by EPA in units of $(mg/kg\text{-}day)^{-1}$ and is derived through an assumed low-dosage linear relationship and an extrapolation from high to low dose-responses determined from animal studies. The value used in reporting the slope factor is the upper 95 percent confidence limit.

4.5.2.2 Applicable or Relevant and Appropriate Requirements

Evaluation of the public health and environmental risks necessitates consideration of currently available water quality standards or Applicable or Relevant and Appropriate Requirements (ARARs), as defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Superfund Amendments and Reauthorization Act (SARA).

Table 4-5 presents available regulatory standards or guidelines for the indicator chemicals selected in the preceding section. Currently, the only enforceable Federal regulatory standards for exposures to ground-water contamination are the Maximum Contaminant Levels (MCLs). However, MCLs have not been specified for the majority of the indicator chemicals selected at Sheppard AFB. Therefore, regulatory guidelines may be used for comparative purposes to infer health risks and environmental impacts. Relevant regulatory guidelines include the Ambient Water

R34892

TABLE 4-5

REGULATORY REQUIREMENTS AND DOSE PARAMETERS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Site Contaminant	EPA SDWA Standard			EPA Drinking Water Health Advisories (Status) (µg/l)	EPA DWEL (µg/l)	Federal Ambient Water Quality Criteria (µg/l)	
						Human Health	Aquatic Life
	NIPDWR	MCLG	MCL			Ingestion of water plus consumption of aquatic life/ingestion of aquatic life only.	Acute/Chronic
Arsenic	50 (1)	0 (T)	NA	NA	NA	0.002/.0175 (2)	360/190 A_s^{+3} 850/48 A_s^{+5}
Chromium (Total)	50 (1)	100 (P) (1)	100 (P) (1)	110 day child: 1,000 Longer term child: 200 Longer term adult: 800	200 (1)	50/NA (3)	16/11 C_t^{+6} (4)
Antimony	NA	3 (T) (1)	10/5 (T) (1)	110 day child: 15 Longer term child: 15 Longer term adult: 15 (1) (D)	15 (1)	46/45,000 (2)	9,000/1,800 (2)
Nickel	NA	100 (T) (1)	100 (T) (1)	1/10 day child: 1,000 Longer term child: 100 Longer term adult: 600 (1) (F)	600 (1)	15.4/13.4 (5)	71/7.9 (6)
Lead	50 (1)	0 (P)	TT (P)	NA	NA	50/NA (3)	83/3.2 (4) (7)
Fluoride	1.4 - 2.4 (1)	4,000 (F) (1)	4,000 (F) (1)	NA	NA	NA	NA
Nitrate (as N)	10,000 (1)	10,000 (P) (1)	10,000 (P) (1)	10 day child: 10,000 (1)	NA	10,000/NA (2)	NA
Benzene	NA	0 (F) (1)	5 (F) (1)	1/10 day child: 200 (F)	NA	0.86/40 (2)	5,300/NA (2)
Bis(2-ethylhexyl) phthalate	NA	0 (T) (1)	4 (T) (1)	NA	NA	15,000/50,000 (2)	NA

TABLE 4-5

REGULATORY REQUIREMENTS AND DOSE PARAMETERS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Site Contaminant	EPA SDWA Standard			EPA Drinking Water Health Advisories (Status) (µg/l)	EPA DWEL (µg/l)	Federal Ambient Water Quality Criteria (µg/l)	
						Human Health	Aquatic Life
	NIPDWR	MCLG	MCL			Ingestion of water plus consumption of aquatic life/ingestion of aquatic life only.	Acute/Chronic
Chlordane	NA	0 (P) (1)	2 (P) (1)	1/10 day child: 60 Longer term child: 0.5 Longer term adult: 0.5	2 (1)	.00046/.00048 (2)	2.4/.0043 (2)
Dieldrin	NA	NA	NA	1/10 day child: 0.5 Longer term child: 0.5 Longer term adult: 2 (1) (F)	2 (1)	.00071/.000078 (2)	2.5/.0019 (2)
Heptachlor epoxide	NA	0 (P) (1)	0.2 (P) (1)	1/day child: 10 Longer term child: 0.1 Longer term adult: 0.1	0.4 (1)	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	1,060/14 (2)
4,4-DDD	NA	NA	NA	NA	NA		
4,4'-DDT	NA	NA	NA	NA	NA	.000024/.000024 (2)	1.1/.001
Heptachlor	NA	0 (P) (1)	0.4 (P) (1)	1/10 day child: 10 Longer term child: 5 Longer term adult: 5	20 (1)	.00028/.00028 (2)	0.52/.0036 (2)

R34892

TABLE 4-5

REGULATORY REQUIREMENTS AND DOSE PARAMETERS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Site Contaminant	EPA SDWA Standard			EPA Drinking Water Health Advisories (Status) (µg/l)	EPA DWEL (µg/l)	Federal Ambient Water Quality Criteria (µg/l)	
						Human Health	Aquatic Life
	NIPDWR	MCLG	MCL			Ingestion of water plus consumption of aquatic life/ingestion of aquatic life only.	Acute/Chronic
Chlordane	NA	0 (P) (1)	2 (P) (1)	1/10 day child: 60 Longer term child: 0.5 Longer term adult: 0.5	2 (1)	.00046/.00048 (2)	2.4/.0043 (2)
Dieldrin	NA	NA	NA	1/10 day child: 0.5 Longer term child: 0.5 Longer term adult: 2 (1) (F)	2 (1)	.00071/.000078 (2)	2.5/.0019 (2)
Heptachlor epoxide	NA	0 (P) (1)	0.2 (P) (1)	1/day child: 10 Longer term child: 0.1 Longer term adult: 0.1	0.4 (1)	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	1,060/14 (2)
4,4-DDD	NA	NA	NA	NA	NA		
4,4'-DDT	NA	NA	NA	NA	NA	.000024/.000024 (2)	1.1/.001
Heptachlor	NA	0 (P) (1)	0.4 (P) (1)	1/10 day child: 10 Longer term child: 5 Longer term adult: 5	20 (1)	.00028/.00028 (2)	0.52/.0036 (2)

Quality Criteria (AWQC), Maximum Contaminant Level Goals (MCLGs), and Health Advisories (HAs).

Maximum Contaminant Levels (MCLs) - MCLs are enforceable standards promulgated under the SDWA and are designed for the protection of human health. MCLs are based on laboratory or epidemiological studies and apply to drinking water supplies consumed by a minimum of 25 persons. They are designed for prevention of human health effects associated with lifetime exposure (70-year lifetime) of an average adult (70 kg) consuming 2 liters of water per day, but also reflect the technical feasibility of removing the contaminant. These enforceable standards also reflect the fraction of the toxicant expected to be absorbed by the gastrointestinal tract.

Maximum Contaminant Level Goals (MCLGs) - MCLGs are specified as zero for carcinogenic substances, based on the assumption of nonthreshold toxicity, and do not consider the technical or economic feasibility of achieving these goals. MCLGs are nonenforceable guidelines based entirely on health effects. The MCLs have been set as close to the MCLGs as is considered technically and economically feasible.

Ambient Water Quality Criteria (AWQC) - AWQC are not enforceable regulatory guidelines and are of primary utility in assessing acute and chronic toxic effects in aquatic organisms. They may also be used for identifying human health risks. AWQCs consider acute and chronic effects in both freshwater and saltwater aquatic life, and adverse carcinogenic and noncarcinogenic health effects in humans from ingestion of both water (2 liters/day) and aquatic organisms (6.5 grams/day), and from ingestion of water alone (2 liters/day). The AWQCs for protection of human health for carcinogenic substances are based on the EPA's specified incremental cancer risk range of one additional case of cancer in an exposed population of 10,000,000 to 100,000 persons (i.e., the 10^{-7} to 10^{-5} range) and are generally based on older toxicologic data.

Health Advisories (HAs) - HAs are guidelines developed by the EPA Office of Drinking Water for nonregulated contaminants in drinking water. These guidelines are designed to consider both acute and chronic toxic effects in children (assumed body weight of 10 kg) who consume 1 liter of water per day or in adults (assumed body weight of 70 kg) who consume 2 liters of water per day. HAs are generally available for acute (1-day), subchronic (10-day), and chronic (long-term) exposure scenarios.

These guidelines are designed to consider only threshold effects, and as such, are not used to set acceptable levels of known or probable human carcinogens.

4.5.3 Exposure Assessment

The purpose of this section is to evaluate the potential for human exposure to the hazardous compounds associated with the sites which may pose a risk at Sheppard AFB. This section covers the following:

- Characterization of the potentially exposed populations.
- Identification of actual or potential routes of exposure.
- Description of the process by which exposures are quantified.

Detailed descriptions of the magnitude of exposures are presented in later sections for each site.

To determine whether an actual exposure or a potential for exposure currently exists, one must consider the most likely pathways of contaminant release and transport as well as the human and environmental activity patterns in the area. A complete exposure pathway has three components:

- A source of chemicals that can be released to the environment.
- A route of contaminant transport through an environmental medium.
- An exposure or contact point for a human or environmental receptor.

These components are addressed in the following subsections. In the final subsection, the magnitude of exposure is estimated.

The field investigation activities produced environmental samples for the following matrices: surface soil, subsurface soil, ground water, tank waste, blanks, rinsates, and duplicates. Summaries of the detectable contaminant levels are illustrated on a site-by-site basis in Sections 5.0 through 16.0. At sampling points where a duplicate sample was collected, the maximum concentration of each contaminant from the two samples is used to represent the concentration at that location.

In Sections 5.0 through 16.0, average contaminant concentrations are presented for each medium sampled at each site. These results not only provide an indication of the general problem at each site, but also are used as input to the exposure assessment in order to present a range of potential risks. The averages presented on the contaminant occurrence and distribution tables consider positive detections only. For risk assessment purposes, the averages used are frequently arithmetic averages, and all nondetected values were treated as "zero" during the calculation. This serves to eliminate any bias toward unreasonably large average concentrations that are determined using the average of only the detected values or that are determined using geometric means calculated using one-half the method or sample detection limit. The use of the arithmetic average as calculated above, versus other methods, has very little overall impact on the risk estimates, which are essentially order-of-magnitude indications of potential public health threats.

4.5.3.1 Receptor Identification

Human receptors potentially exposed to site-related contamination are as follows:

- Persons currently residing on or near IRP sites of concern, including both children and adults. These individuals may be exposed to contaminants through routine or occasional contact with site surface soils.

- Base personnel performing planned or recreational activities at or near IRP sites of concern.

- Persons living downgradient of an IRP site and using the shallow ground water as a domestic water supply source.

- People who at sometime in the future may reside on site property, if the property is sold (current land-use and Sheppard AFB changes). A worst-case scenario is that these residents would use the ground water as a water supply resource. This exposure scenario is very unlikely, given the quality and quantity of the shallow ground-water resource at Sheppard AFB and the availability of a public water supply.

4.5.3.2 Exposure Routes

Generally, there are three environmental media at the sites through which identified receptors may be directly or indirectly exposed to site-related contamination: air, soils (sediments), and ground water. This section identifies the exposure routes by which receptors are most likely to be at risk.

As discussed previously, indicator compounds were infrequently detected in site ground waters and were found at low-level concentrations only. Consequently, ground -water exposure routes are unlikely to result in elevated risks for receptors of concern. However, the risk assessments presented in the following sections will evaluate (conservatively) risks associated with the routine ingestion of the shallow ground-water aquifer at Sheppard AFB.

Several possible exposure scenarios result from the presence of contaminants in surface and subsurface soils and sediments. Direct contact with contaminated surface soils can result in both a dermal an an accidental ingestion exposure. For example, employees and nearby residents working outdoors may contact contaminated soils, the soil may adhere to hands or clothing, and a small amount is accidentally ingested during eating or drinking (hand-to-mouth contact). These amounts are generally predicted to be very small. Small children are most likely to be exposed to contaminated soil via accidental ingestion. This exposure route is most likely to occur at Site LF04, which is located nearest the base housing.

The sporadic metals and pesticide contamination detected in site surface soils are unlikely to result in significant contaminant levels in the air (migration of contaminants via wind erosion of contaminated soil particulates). Therefore, air exposure routes will not be evaluated in the risk assessment.

4.5.3.3 Exposure Estimates

The last step in an exposure assessment is to estimate the doses of contaminants incurred by a receptor. This section provides route-specific estimates of contaminants to which a receptor may be exposed. Estimated doses of contaminants are presented in Appendix H.

A dose is defined as the amount of a compound (in milligrams) absorbed (per day) by a receptor (per kilogram of body weight). Doses can be calculated for a lifetime exposure (for carcinogenic effects) or for either chronic or one-time acute exposures (for noncarcinogenic effects). A dose is generally estimated as follows:

$$\text{Dose} = \frac{(\text{Contaminant Concentration}) \times (\text{Contact Rate}) \times (\text{Absorbed Fraction})}{\text{Body Weight}}$$

Exposure duration is an important factor in calculating doses. A time-weighting factor for lifetime exposures is used for estimating does of carcinogens, while for noncarcinogens, an annual time-weighting factor is more appropriate. Both plausible and worst-case exposure scenarios were developed , as necessary, for the sites discussed in Sections 5.0 through 16.0 using the arithmetic average and maximum contaminant concentrations, respectively.

Ground Water

The sampling and analysis of on-site ground-water monitoring wells during the RI indicate that the organic and inorganic contaminants are infrequently detected in the ground water underlying Sheppard AFB. Currently, the shallow ground-water resource is not used as a domestic water supply source, and future use is unlikely. The risk assessment conservatively evaluates the exposure to ground-water contaminants in the unlikely event that the ground water is used as a water supply source at sometime in the future.

Several routes of exposure are associated with the household use of contaminated water. Receptors may be exposed via ingestion; via inhalation of volatiles and semivolatiles emitted from showers, toilets, dishwashers, washing machines, and other turbulent sources; or via dermal contact during bathing. Given the low-level contamination detected, only the ingestion route of exposure will be evaluated in the risk assessment.

Ingestional exposures are estimated using the following expressions (adapted from EPA, 1986):

$$\text{Dose} = \frac{C \times IR \times AF \times \dfrac{\text{days of exposure}^{(1)}}{\text{Year}}}{BW \times \dfrac{365\ \text{days}}{\text{year}}}$$

where:

Dose = Daily intake per unit body weight (mg/kg/day)
C = Contaminant concentration in water (mg/L)
IR = Ingestion rate (liters/day)
AF = Absorption fraction (decimal fraction)
BW = Receptor body weight (kg)

The ingestion rate was set at 2 liters/day for a 70-kg adult receptor under the residential use scenario. The absorption fraction was specified as 100 percent (1.0) for all ground-water contaminants.

<u>Surface Soils</u>

Exposures to contaminated surface soils could occur in the following ways:

- Adults/children contacting soils near homes constructed on site. (This is particularly relevant for Site LF04).

- Workers/base personnel employed at an industrial or commercial facility operating at the site and performing work tasks outdoors.

Residential Use Scenario

A model developed by Hawley (1985) estimates exposures through soil and dust ingestion, inhalation, and dermal contact, both inside and outside a residence. The model considers children and adults. Maximum daily doses are estimated for small

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(1) Years of exposure per a 70-year lifetime are also considered for the carcinogenic dose calculation.

children and adults by adding the maximum daily exposure rates for each route of exposure (see Appendix H). The model, which assumes that a 2-1/2 year old child consumes 300 mg/day of soil, was modified to reflect a 200 mg/day soil ingestion rate (Current EPA Guidance). Doses are estimated as follows:

$$\text{Dose} = \frac{C \times CR \times AF}{BW}$$

where:

Dose = Daily contaminant intake rate (mg/kg/day)
C = Contaminant concentration in soil (mg/kg)
CR = Contact rate (oral, ingestion, or dermal) (mg/day)
AF = Absorption fraction (decimal fraction)
BW = Receptor body weight (kg)

Average annual daily doses from the three exposure routes were used to develop carcinogenic risk estimates. The three age groups specified by Hawley were used to integrate exposures over the various stages of a lifetime. The intake rates presented in the spreadsheets in Appendix H are based on the summations of all exposures of a certain type (e.g., ingestion for each age bracket).

The average annual daily dose is derived as follows:

$$\text{Dose} = \frac{C \times CR \times AF \times ED}{BW}$$

where:

Dose = Daily contaminant intake rate (mg/kg/day)
C = Contaminant concentration in soil (mg/kg)
CR = Contact rate (oral, ingestion, or dermal) (mg/day)
AF = Absorption fraction (decimal fraction)
BW = Receptor body weight (kg)
ED = Exposure duration

For details on these variables, see the relevant equation portion of Appendix H.

Occupational/Recreational Use Scenario

Base personnel performing planned activities or residents occasionally visiting the sites of concern may also contact site surface soils. Exposure doses are estimated for receptors of concern for the dermal contact and accidental ingestion routes of exposure. Dermal contact with contaminated surface soils may result in the absorption of chemicals (e.g., pesticides). Doses incurred through this route of exposure can be estimated as follows:

$$\text{Dose} = \frac{C \times SA \times AF \times AR \times ER^{(1)}}{BW \times 365 \text{ days/yr}}$$

where:

Dose	=	Daily intake per unit body weight per event (mg/kg-day)
C	=	Contaminant concentration (mg/kg)
SA	=	Exposed surface area of skin (cm^2)
AF	=	Absorption fraction (decimal fraction)
AR	=	Soil adherence per unit area ($mg/cm^2/day$)
ER	=	Exposure rate (days/year)
BW	=	Body weight (kg)

The following input parameters were used to estimate exposure doses for base personnel working at a site or an adolescent occasionally visiting a site of concern.

- SA = 940 cm^2 (children); 1,800 cm^2 (adult) (NUS estimate, 10 percent body surface area)
- BW = 45 kg (children); 70 kg (adults)
- ER = 250 day/year, 10 years (base personnel)
  = 52 day/year (45 Kg child occasionally trespassing across a site)

(1) Years of exposure per a 70-year lifetime are also considered for the carcinogenic dose calculation.

- AF = 0.05
- AR = 2.77 mg/cm2/day (EPA, April 1988).

Exposure doses for the accidental ingestion (route of exposure) of soil can be estimated using the following equation:

$$\text{Dose} = \frac{C \times IR \times AF \times ED^{(1)}}{BW \times 365\ days/yr}$$

where:

Dose	=	Daily intake of contaminant per unit body weight per event (mg/kg-day)
C	=	Contaminant concentration in soil (mg/kg)
IR	=	Ingestion rate (mg/day)
AF	=	Absorption fraction (decimal fraction)
ED	=	Exposure duration (days/year)
BW	=	Body weight (kg)

For all ingested contaminants, absorption by the gastrointestinal tract is conservatively assumed to be 100 percent. An ingestion rate of 50 mg/day (NUS estimate, 50 percent of predicted soil ingestion rate for the residential use scenario) is used to represent the amount of soil accidentally ingested.

Details on the equations used to calculate potential doses are presented in Appendix H. Sample calculations precede the spreadsheets for each exposure scenario.

4.5.4 Risk Characterization

The objective of this section is to estimate the potential for adverse health or environmental effects under the exposure scenarios defined in Section 4.5.3. EPA guidelines (September 24, 1986b) for the use of dose-additive models are used to combine the risks for individual chemicals to estimate cumulative risks for the mixtures found on site, assuming that the toxicologic endpoints (effects) are the same. This section characterizes the potential carcinogenic and noncarcinogenic risks associated with the sites at Sheppard AFB.

4.5.4.1 Uncertainty in Risk Assessment

Carcinogenic and noncarcinogenic health risks are estimated using a number of different assumptions. Therefore, the values presented in this section contain an inherent amount of uncertainty. The extent to which health risks can be characterized is primarily dependent upon the accuracy with which the toxicity of a chemical can be estimated and the accuracy of the exposure estimates. The toxicological data that form the basis for all risk assessments contain uncertainty in the following areas:

- The extrapolation of nonthreshold (carcinogenic) effects from the high doses administered to laboratory animals to the low doses received under more common exposure scenarios.

- The extrapolation of the results of laboratory animal studies to human or environmental receptors.

- The interspecies variation in toxicological endpoints used in characterizing potential health effects resulting from exposure to a chemical.

- The variations in sensitivity among individuals of any species.

In addition to the sources of uncertainty listed above, the chemical analytical data base has limitations in such areas as sample locations, sample representativeness, and accuracy of the analytical result. Every effort is made to collect samples that reflect actual site conditions, but not every portion of every site was sampled on an unbiased grid.

4.5.4.2 Carcinogenic Risks

Carcinogenic risks can be estimated by combining information in the dose-response assessment (carcinogenic potency factors) with an estimate of the individual intakes (doses) of a contaminant by a receptor.

Risk can be modeled as follows (EPA, September 24, 1986a):

$$\text{Risk} = (q^*)(\text{Dose})$$

where:

q^* = Carcinogenic potency factor (slope of the dose-response curve in kg-day/mg (from Table 4-4).

Dose = Amount of a contaminant absorbed by a receptor in mg/kg-day.

The resulting number (risk) is a unitless expression of an individual's likelihood of developing cancer as a result of exposure to the carcinogenic indicator chemicals. Where the above equation results in a risk greater than 0.1, the following equation is used:

$$\text{Risk} = 1 - \exp\,(q^*)(\text{Dose})$$

This calculated incremental risk is in addition to the risks incurred by everyday activities. The risk (e.g., 1×10^{-6} or a 1 in 1,000,000 chance) can also be applied to a given population to determine the number of excess cases of cancer that could be expected to result from exposure (e.g., 1×10^{-6} is one additional case of cancer in 1,000,000 exposed persons).

The total risk for exposure to multiple compounds is presented as the summation of the risks for the individual contaminants. Risks can be calculated in this manner under the following assumptions:

- There are no antagonistic/synergistic effects between chemicals.
- All chemicals produce the same result (cancer).
- The exposed populations are the same (EPA, September 24, 1986a).

Detailed risk calculations are presented in Appendix H for each exposure scenario developed in Section 4.5.3. All input assumptions and parameters are defined for each scenario. Appendix H also includes total incremental lifetime cancer risks for each exposure scenario.

4.5.4.3 Noncarcinogenic Risks

Potential health risks resulting from exposure to noncarcinogenic compounds are estimated by comparing a time-weighted daily dose to an acceptable level, such as an RfD. If the ratio (the Hazard Quotient [HQ]) exceeds unity, there is a potential health risk associated with exposure to that particular chemical (EPA, September 24, 1986b). The ratios can be summed for exposures to multiple contaminants. This sum, or Hazard Index, is not a mathematical prediction of the severity of toxic effects; it is simply a numerical indicator of the transition from acceptable to unacceptable levels.

A total Hazard Index for any exposure route is calculated by summing the Hazard Indices for the individual chemicals of concern (EPA, October 1986). Hazard Indices and RfDs are subject to the uncertainties described in Section 4.5.4.1.

4.5.4.4 Qualitative Risk Assessment

As a supplement to the quantitative risk assessment described generally in Sections 4.5.4.2 and 4.5.4.3, a qualitative risk assessment will be presented on a site-by-site basis in Sections 5.0 through 16.0. This assessment includes a comparison of site-specific data to ARARs.

5

5.0 BASE BACKGROUND

5.1 SITE BACKGROUND

A site for use as a background sampling location was selected by an NUS hydrogeologist during the field effort. The location does not constitute an IRP site and was selected based on the likelihood that the site would yield useful background data for comparison with site-specific analytical results. The site was located in a vacant lot near the Sheppard AFB Elementary School, hydrologically upgradient of any known IRP site. A single boring was drilled at the site and completed as monitoring well BB-01 (see Figure I-3 in Appendix I). Background subsurface soil samples were collected from the boring, and a ground-water sample was collected from the well.

The boring was advanced to a depth of 50 feet after water was encountered at 40 feet. However, after the boring was allowed to stand open for a day, the water level rose to above a small ground-water seep that was encountered at about 20 feet. The well screen was installed to intersect the moist interval. The subsurface material at the background site consisted of sandy clay and sandy silt, typical of locations elsewhere on the base.

5.2 BACKGROUND CONCENTRATIONS

Table 5-1 presents background concentrations of chemicals detected in two subsurface soil and ground-water samples analyzed for TCL VOCs, BNAs, PCBs, and Priority Pollutant metals. In addition, the ground-water sample was analyzed for total dissolved solids (TDS) and common anions. The subsurface soil samples were analyzed for cation exchange capacity (CEC) and gamma radio isotopes.

Background inorganic concentrations for the subsurface soil samples were similar to or less than published values of background levels for north-central Texas. Bis(2-ethylhexyl) phthalate was the only organic compound detected in the background soil samples. As a result of its use in plastics, this compound is prevalent in the environment, and it was detected in numerous soil samples obtained at the base during a previous sampling round.

TABLE 5-1

BACKGROUND CONCENTRATIONS AND DRINKING WATER STANDARDS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Parameter	Subsurface-Soil Concentration	Regional Background[a]	Ground-Water Concentration	Standard Criteria
Bis(2-ethylhexyl)phthalate	80 µg/kg	NA	ND	NA
Arsenic	2 mg/kg	6.5 mg/kg	ND	50 µg/L[c]
Chromium	10.9 mg/kg	80 mg/kg	ND	50 µg/L[c]
Copper	32.1 mg/kg	15 mg/kg	ND	1,300 µg/L[d]
Lead	6 mg/kg	31.5 mg/kg	ND	50 µg/L[c]
Mercury	0.4 mg/kg	0.04 mg/kg	ND	0.2 µg/L[c]
Nickel	27.7 mg/kg	37.5 mg/kg	ND	100 µg/L[d]
Selenium	ND	0.6 mg/kg	4.17 µg/L	10 mg/L[c]
Zinc	36.2 mg/kg	33.5 mg/kg	ND	5,000 mg/L[b]
Gamma TH 232	0.9 ± 0.1 pCi/g	NA	NA	NA
Gamma RA 228	1.0 ± 0.1 pCi/g	NA	1.8 ± 0.7 pCi/L	5 pCi/L
Gamma RA 226	0.8 ± 0.1 pCi/g	NA	NA	5 pCi/L
Cation Exchange Capacity	10.6 meq/100g	NA	NA	NA
Chloride	NA	NA	90.7 mg/L	250 mg/L[b]
Nitrate	NA	NA	65.9 mg/L	10 mg/L[c]
Sulfate	NA	NA	62.4 mg/L	250 mg/L[b]
Fluoride	NA	NA	0.82 mg/L	4 mg/L[c]
Bromide	NA	NA	0.5 mg/L	NA
Total Dissolved Solids	NA	NA	796 mg/L	500 mg/L[c]

Notes: ND - not detected.
NA - not applicable - either not analyzed for this parameter or data not available.

Background concentrations for radiological parameters were established from a sampling of several wells around the base. Values expressed here are from the background sampling location (BB01) only.

(a) Shacklette and Boerngen, 1984.
(b) Secondary Drinking Water Standard.
(c) National Interim Drinking Water Standard
(d) USEPA, April 1989.

It should also be noted that this compound is a common laboratory artifact, although the results could not be rejected as false positives during data validation efforts.

Background concentrations determined through site-specific sampling and analysis, as well as literature background values, will be used to identify chemicals present at concentrations in excess of background. Such compounds may be present as a result of past chemical use, storage, or disposal activities at individual sites.

6

6.0 SITE FT01 - FIRE PROTECTION TRAINING AREA 1

6.1 SITE BACKGROUND AND HISTORY

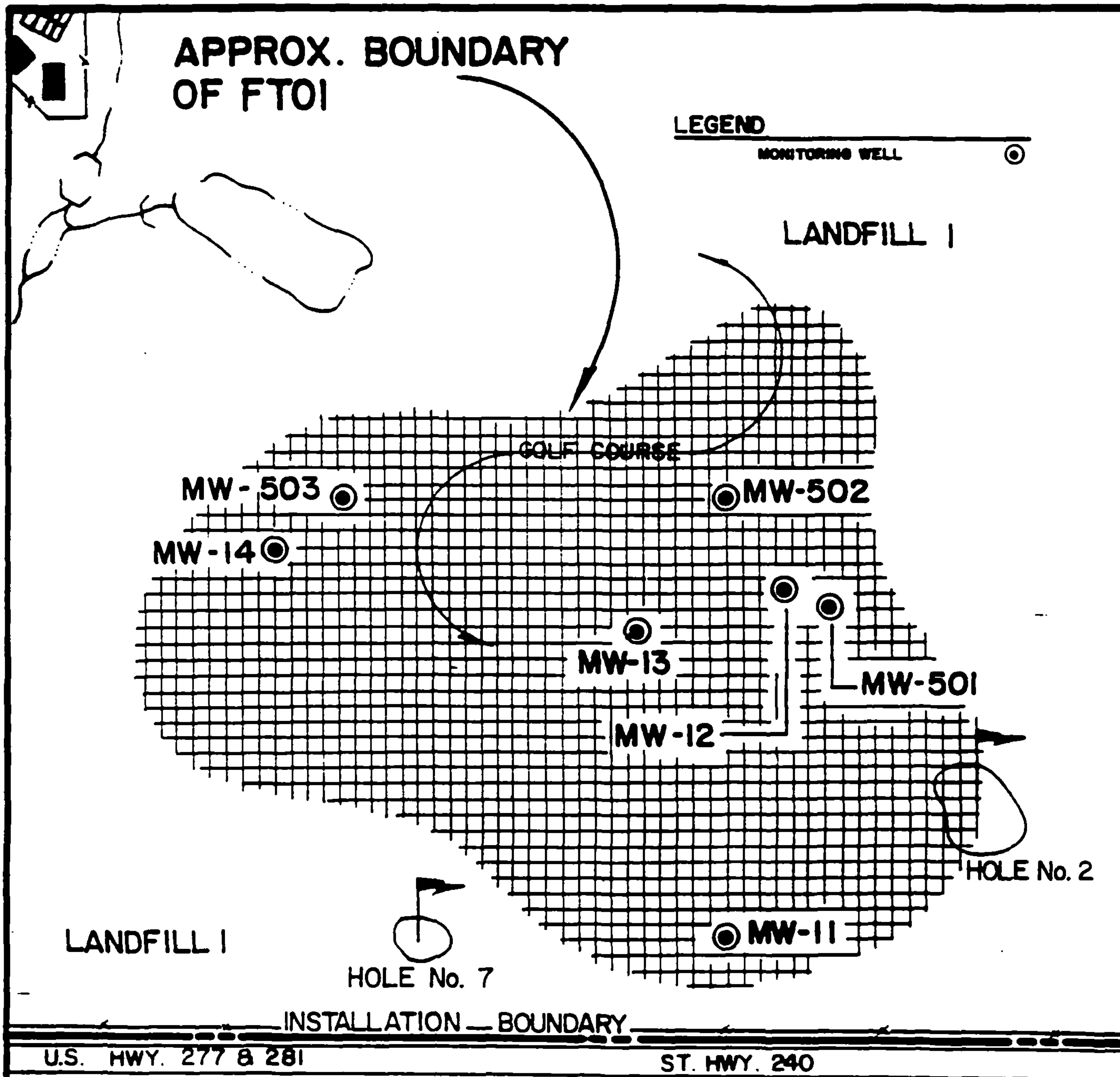
Fire Protection Training Area 1 (FT01) is located within Landfill 1 (LF04) and was used for training exercises from 1941 until 1957 (Figure 6-1). The site consisted of a depressed burning area and three old aircraft. A drum storage area north of, and adjacent to, the site was used to store between 100 and 200 fifty-five gallon drums of contaminated oils, fuels, and waste solvents from aircraft maintenance and industrial shop activities. The frequency and duration of burns during the 1940s is unknown. During the 1950s, drums were transported by flat-bed truck from the drum storage area to the fire protection training site for use as fuel. During the 1950s, four or five burns occurred each weekend day. Each burn consumed approximately 400 to 500 gallons of the various fuels. As far as can be determined, no drainage collection system was operational at this site.

Visual examination of the area currently reveals no evidence that the site was once a fire protection training area. The site was filled and graded and is now part of the base golf course. As a result of the nature and duration of activities and the relatively shallow depth to ground water, a potential for contaminant migration exists.

A subsurface investigation was conducted at FT01 in conjunction with the Phase II investigation conducted by Radian. During the confirmation study, four monitoring wells were installed ranging in depth from 18 to 30 feet, and four coreholes were drilled ranging in depth from 3 to 4 feet. Ground water was encountered from 0.4 to 6.3 feet below the ground surface. Low levels of hydrocarbon and organic contamination were detected in the shallow ground water on the site. A suspected contaminant plume was identified by an electromagnetics (EM) survey. The Radian report concluded that the potential exists for on- and off-base contamination (Radian, 1987).

6.2 GEOPHYSICAL INVESTIGATION

An EM survey was used to detect and locate any contaminant migration resulting from past activities at FT01. Positions of the grid were extended 500 feet beyond the



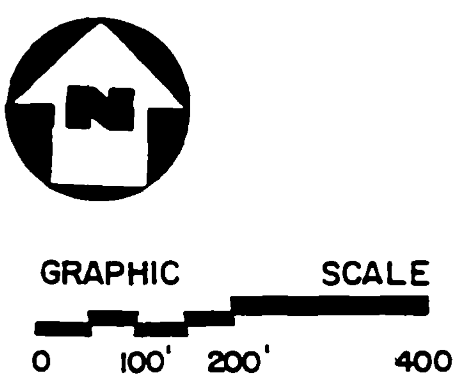


FIGURE 6-1
SITE PLAN
FIRE PROTECTION TRAINING AREA I (FT01)
SHEPPARD AIR FORCE BASE

NUS CORPORATION

planned limits of the grid to obtain closure of a zone that produced some anomalous readings. EM reading stations were located 25 feet on center within the grid.

It had been reported that a sandstone layer exists below the site. Therefore, two reconnaissance resistivity soundings were made to screen the subsurface for sandstone and to see whether the method could be applied at the site on a larger scale. Soil and topographic variability did not permit accurate depth estimates and, therefore, detailed sounding was not used at the site (Radian, 1987).

6.3 SOIL GAS SURVEY

During the RI, an NUS subcontractor conducted a soil gas survey at FT01 in November 1988. Thirty soil gas samples were collected on a sampling grid on roughly 50-foot centers positioned in a downgradient position to the site. Samples of soil gas were collected by producing a 1/2-inch hole to a depth of 3 to 4 feet using a slide hammer, then inserting a stainless steel probe to the bottom of the hole to extract a vapor sample. The sample was then shipped to a laboratory for analysis. The results of the analyses showed low levels of hydrocarbon contamination at one sampling point. The soil gas survey report is included as Appendix D.

6.4 HYDROGEOLOGIC INVESTIGATION

In addition to the four monitoring wells installed by Radian (1987), NUS installed three borings in the vicinity of, but generally downgradient from, the presumed location of the former fire protection training area. The borings ranged in depth from 19.6 feet (MW-14) to 32 feet (MW-502) (Figure 6-2). The borings penetrated mostly sand and sandstone beneath a surficial layer of sandy clay or siltstone, then reached a substantial thickness (greater than 14 feet) of clay. The top of the clay was encountered from 17 feet (MW-501) to 25 feet (MW-12) below ground surface. The yellowish-brown sand was fine-grained, moderately sorted, and contained a silty-clay matrix. The clay was reddish or grayish-brown and was dry and apparently acted as an effective aquitard to the downward migration of ground water. Figures I-3 and I-4 (Appendix I) illustrate the subsurface geology at FT01.

Ground water was encountered in all borings during drilling at depths ranging from 5 to 10 feet. In the summer months, the water-level rises significantly (2 to 3 feet) in response to continual irrigation of the golf course. Ground water at the site represents a water table aquifer within the sand unit, which is perched above the clay layer (Figure I-4 [Appendix I]). Water-level data show a strong northwesterly gradient across the site, toward the creek, which flows off base. Seeps reported near the creek (Radian, 1987) may indicate where the sand-clay contact intersects the ground surface. Figure 6-2 is a water table contour map showing the direction of ground-water flow, at FT01. Figure I-5 (Appendix I) is a similar map illustrating water levels in the general vicinity of FT01 and LF04.

Slug tests conducted at MW-501, MW-502, and MW-503 yielded an average hydraulic conductivity value of 9.5×10^{-4} cm/sec for the perched aquifer.

6.5 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

6.5.1 Subsurface Soil

During Round I of the NUS investigation (1988), nine subsurface soil samples from varying depths were collected from three soil borings. Based on concern over past practices at FT01, the samples were analyzed for TCL VOCs, BNAs, and PCBs, as well as Priority Pollutant metals. Figure 6-1 indicates these soil boring locations. Sample-specific analytical results are displayed on Figure I-6 (Appendix I) and are summarized on Table 6-1. None of the organic contaminants targeted by the analytical program were detected. The inorganic concentrations detected are generally similar to base and/or published background metals concentrations in soils.

6.5.2 Ground Water

In addition to the four monitoring wells (MW-11, MW-12, MW-13, and MW-14) installed by Radian, NUS installed three monitoring wells (MW-501, MW-502, and MW-503). The NUS wells are located downgradient of the former fire protection training area and are shown on Figure I-5 (Appendix I). Ground water was encountered at rather shallow depths and tends to flow in a northwesterly direction across the site, towards the unnamed creek that flows along the base boundary.

As part of the Round I investigation, seven ground-water samples were collected and analyzed for TCL VOCs, BNAs, and PCBs, as well as Priority Pollutant metals, common anions, and TDS. Round II ground-water samples collected from MW-502 and MW-503 were analyzed for TCL VOCs, BNAs, PCBs, and Priority Pollutant metals. Sample-specific results are displayed on Figure I-8 (Appendix I) and are summarized

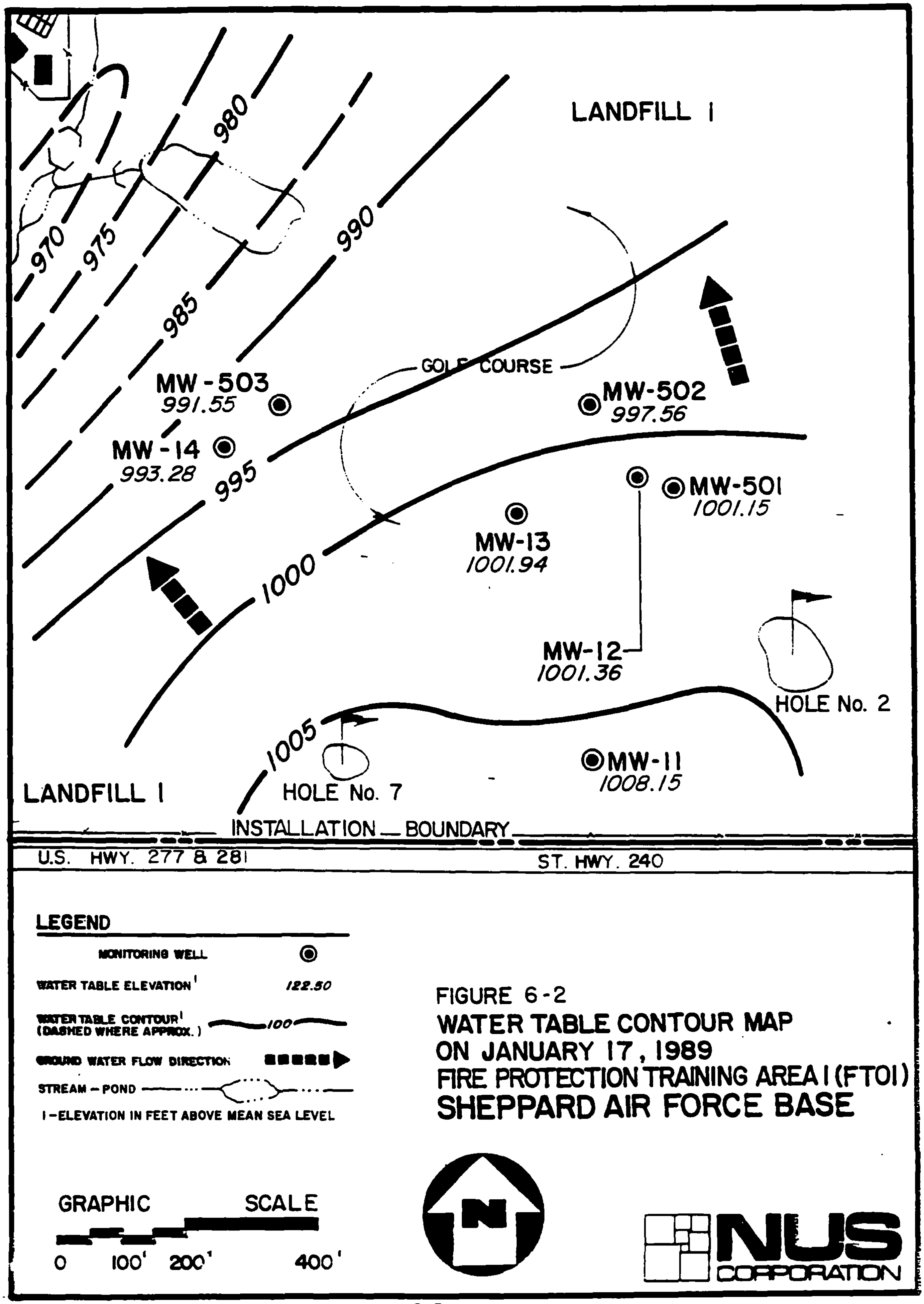


FIGURE 6-2
WATER TABLE CONTOUR MAP
ON JANUARY 17, 1989
FIRE PROTECTION TRAINING AREA I (FT01)
SHEPPARD AIR FORCE BASE

R34892

TABLE 6-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE FT01
SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[(a)]	Regional Background Concentration[(b)]	Number Detections/ Number Samples	Range of Concentration	Average Concentration
PHASE I					
Arsenic (mg/kg)	2	6.5	9/9	1.3-5.7	2.733
Chromium (mg/kg)	10.9	80	9/9	6.6-18.3	10.8
Copper (mg/kg)	32.1	15	9/9	6.5-34.9	12.0
Lead (mg/kg)	6	31.5	9/9	2.4-59	12.0
Mercury (mg/kg)	0.4	0.04	8/9	0.10-0.20	0.12
Nickel (mg/kg)	27.7	37.5	8/9	10.3-31.9	17.2
Zinc (mg/kg)	36.2	33.5	9/9	17.9-130	46.6

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.

in Table 6-2. The following organics were detected infrequently in the ground-water samples collected at FT01:

- Bis(2-ethylhexyl)phthalate C_{max} = 110 µg/L
- Di-n-octyl phthalate C_{max} = 6 µg/L
- Trichloroethene C_{max} = 3 µg/L

The nature of the contaminants, the low concentrations detected, and the fact that these compounds were not detected in site soil samples indicate that these results are not strongly indicative of ground-water/soil contamination resulting from the site use as a fire protection training area. The chloride, nitrate, and TDS concentrations are more likely to be associated with background conditions or the landfill in which FT01 is located than with contamination originating from FT01. The following metals concentrations are above background and may be reflective of site use as an FPTA, assuming solvents and oils containing metallic substances were burned in the training area:

- MW-14 - Nickel - C = 248 µg/L
- MW-503 - Nickel - C = 161 µg/L
  - Chromium - C = 1,850 µg/L
- MW-502 - Chromium - C = 105 µg/L

The concentrations detected exceed the current MCL for chromium (50 µg/L) and the tentatively proposed MCL for nickel (100 µg/L). The metals may reflect the landfill conditions in which FT01 is located. It should be noted, however, that metals concentrations were not as great in the monitoring wells installed to investigate LF01 (MW-301, and MW-302). Tables 6-3 and 6-4 summarize the ground-water and soil analytical data at FT01.

6.6 POTENTIAL PUBLIC HEALTH RISKS

The organic and inorganic (metals) contamination sporadically detected in the FT01 monitoring wells is limited evidence of the use of the site as a fire protection training area. However, any interpretation of the analytical results is complicated by the fact that the site is located within a landfill area and the contaminants reported in the site ground water were not detected in subsurface soil samples collected at the site. This section discusses health risks incurred by human receptors potentially exposed to contaminants detected in the ground water underlying FT01.

R34892

TABLE 6-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE FT01 - GROUND-WATER SAMPLES
ROUND I AND ROUND II
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentration	Average Concentration	Standard/ Criteria
Round I					
Bis(2-ethylhexyl)phthalate (µg/L)	ND	1/7	110	15.7	NR
Di-n-octyl phthalate (µg/L)	NR	1/7	6.0E	1.3	NR
Arsenic (µg/L)	ND	1/7	4.0	0.6	50[c]
Cadmium (µg/L)	NR	1/7	8.0	1.1	10[c]
Chromium (µg/L)	ND	1/7	12.0	1.7	50[c]
Nickel (µg/L)	ND	3/7	22-248	44.8	100[a]
Chloride (mg/L)	90.7	7/7	43.9-591	283.4	250[b]
Nitrate (mg/L)	65.9	7/7	8.7-72.8	35.7	10[c]
Sulfate (mg/L)	62.4	7/7	33.7-237	145.2	250[b]
TDS (mg/L)	796	7/7	330-11,343	2,481	500[b]
Fluoride (mg/L)	0.82	3/7	0.73-0.87	0.33	4[d]
Bromide (mg/L)	0.5	7/7	0.55-1.8	1.27	NR
Phosphate (mg/L)	NR	4/7	41.1-456	97.8	NR

R34892

TABLE 6-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE FT01 - GROUND-WATER SAMPLES
ROUND I AND ROUND II
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration(a)	Number Detections/ Number Samples	Range of Concentration	Average Concentration	Standard/ Criteria
Round II					
Trichloroethene (µg/L)	NR	1/2	3.0	1.5	5(d)
Chromium (µg/L)	ND	2/2	105-1,850	977.5	50(c)
Nickel (µg/L)	ND	2/2	44-161	102.5	100(a)

Notes: NR - not reported.
ND - not detected.
E - estimated value.

(a) Maximum Contaminant Level Goal - EPA, April 1989 unless noted otherwise.
(b) Secondary Drinking Water Standard.
(c) National Interim Primary Drinking Water Standard.
(d) Maximum Contaminant Level.

R34892

TABLE 6-3

GROUND-WATER ANALYTICAL DATA FIRE PROTECTION TRAINING AREA-1 (FT01) SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Arsenic (µg/kg)	Bis(2-ethyl) phthalate (µg/kg)	Bromide (mg/kg)	Cadmium (µg/l)	Chloride (mg/l)	Chromium (µg/l)	Di-n-octyl-phthalate (µg/l)	Fluoride (mg/l)	Nickel (µg/l)	Nitrate (mg/l)	Sulfate (mg/l)	Trichloroethene (µg/l)	Total Dissolved Solids (mg/l)	Total Petroleum Hydrocarbons (mg/l)
SH05-GW-MW501-A	12/19/88	--	--	0 85	--	262 0	--	--	0 73	--	47.1	152 0	--	949	--
SH05-GW-MW502-A	12/19/88	--	--	1.7	--	242.0	--	--	0.77	--	10.8	130 0	--	1,105	--
SH05-GW-MW503-A	12/19/88	--	110	1.5	--	591.0	--	6E	0 87	43.6	50.7	237.0	--	1,418	--
SH05-GW-MW011-A	11/17/88	4	--	0 55	--	43 9	--	--	--	--	8.7	33 7	--	330	118.0
SH05-GW-MW012-A	11/19/88	--	--	1 2	0 8	184 0	--	--	--	--	72.8	146 0	--	11,343	66 8
SH05-GW-MW013-A	11/17/88	--	--	1.3	--	346 0	--	--	--	22	38.7	122.0	--	775	456.0
SH05-GW-MW014-A	11/19/88	--	--	1 8	--	315 0	12	--	--	248	21.1	196 0	--	1,445	--
SH05-GW-MW502-B	07/14/89	--	--	NA	--	NA	105	--	NA	44	NA	NA	3E	NA	NA
SH05-GW-MW503-B	07/14/89	---	--	NA	--	NA	1,850	--	NA	161	NA	NA	--	NA	NA

Note: (--) - analytical results below Contract Required Detection Limits (CRDLs)
E - Estimated value.
NA - Not analyzed for this parameter

R34892

TABLE 6-4

SUBSURFACE SOIL ANALYTICAL DATA
FIRE PROTECTION TRAINING AREA-1 (FT01)
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth	Arsenic (µg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
SH05-SU-SB501-A	12/08/88	4	2.1	8.7	8.6	2.8	0.1	11.1	17.9
SH05-SU-SB501-B	12/08/88	16	2.3	11.4	13	3.8	0.2	15	38.9
SH05-SU-SB501-C	12/08/88	18	2.6	11.1	34.9	59	0.2	18.2	130
SH05-SU-SB502-A	12/08/88	2	4	10	8.2	7.5	0.2	10.3	25
SH05-SU-SB502-B	12/08/88	8	3.5	12.7	8.3	5.5	0 2	16.7	45.1
SH05-SU-SB502-C	12/08/88	22	1.4	6.6	7.7	11.6	0.2	--	69.1
SH05-SU-MW503-A	12/09/88	2	5.7	18.3	13.8	12	0.2	31.9	27.7
SH05-SU-MW503-B	12/09/88	7	1.3	7.3	7.4	3.8	0.2	15.7	24.7
SH05-SU-MW503-C	12/09/88	10	1.7	10.7	6.5	2.4	--	19	40.6

Note: (--) - analytical results below Contract Required Detection Limits (CRDLs).

Three contaminants (chromium, nickel, and nitrate) were detected in site ground water at levels exceeding current/proposed Federal primary (health-based) standards. It should be noted that the nitrate concentration detected in the base background sample also exceeded the standard. Additionally, two organic chemicals, bis(2-ethylhexyl)phthalate and trichloroethene, which are classified as carcinogens, were detected. Bis(2-ethylhexyl) phthalate was detected in one Round I ground-water sample and trichloroethene was found in a Round II monitoring well sample.

Table 6-5 presents carcinogenic and noncarcinogenic risk assessment results for the primary site contaminants, assuming that the ground water is used as a domestic water supply. The excess lifetime cancer risks estimated for exposure (routine ingestion) to the maximum and average concentrations are 4.09×10^{-5} and 6.2×10^{-6}, respectively. The majority of the risk is attributable to bis(2-ethylhexyl)phthalate; however, the phthalate contamination was not confirmed during the Round II sampling. Additionally, the trichloroethene level detected in one Round II monitoring well is less than the current Federal MCL of 5 µg/l.

The Hazard Quotient calculated for chromium exceeds unity, indicating that adverse noncarcinogenic health effects could be anticipated for a human receptor routinely consuming water containing chromium at the detected concentrations. However, only the chromium concentration detected in one Round II monitoring well is high enough to create a noncarcinogenic health hazard for a human receptor routinely using the ground water for drinking water purposes. As stated previously, the shallow ground water underlying FT01 is not currently used as a domestic water supply source; the risks presented on Table 6-3 are for a theoretical human receptor who may use the ground water as a resource at sometime in the future. However, future use of the ground water is unlikely because the ground water is of limited quality (the common anions levels are high in the shallow ground water) and quantity.

The shallow ground water at FT01 flows in a northwesterly direction and discharges to a creek, which runs through LF04. Although the creek has not been extensively sampled during the RI, volatile organics, chromium, and nickel were not detected in

TABLE 6-5

GROUND-WATER RISK ANALYSIS RESULTS
SITE FTO1
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Concentrations Detected	Exposure Dose (mg/kg/day)[a]	Reference Dose (mg/kg/day)	Hazard Quotient	Cancer Slope Factor $(mg/kg/day)^{-1}$	Incremental Cancer Risk
MAXIMUM CONCENTRATIONS (ROUND I OR ROUND II)						
Bis(2-ethylhexyl)phthalate	100(I)	2.86×10^{-3}	2×10^{-2}	0.14	1.4×10^{-2}	4.0×10^{-5}
Trichloroethene	3(II)	8.57×10^{-5}	NA	-	1.1×10^{-2}	9.4×10^{-7}
Chromium	1,850(II)	5.3×10^{-2}	5×10^{-3}	10.6	NA	-
Nickel	161(II)	4.6×10^{-3}	2×10^{-2}	0.23	NA	-
TOTAL						4.09×10^{-5}
AVERAGE CONTAMINANT LEVELS (POSITIVE DETECTIONS ONLY/ALL SAMPLES) (ROUND I OR ROUND II)						
Bis(2-ethylhexyl)phthalate	110/15.7 (I)	2.86×10^{-3}/ 4.1×10^{-4}	2×10^{-2}	0.14/0.02	1.4×10^{-2}	4.0×10^{-5}/ 5.7×10^{-6}
Trichloroethene	3/1.5 (II)	8.57×10^{-5}/ 4.3×10^{-5}	NA	-	1.1×10^{-2}	9.4×10^{-7}/ 4.7×10^{-7}
Chromium	977.5/977.5 (II)	2.8×10^{-2}	5×10^{-3}	5.6	NA	-
Nickel	102.5/102.5 (II)	2.9×10^{-3}	2×10^{-2}	0.15	NA	-
TOTAL						4.09×10^{-5}/ 6.2×10^{-6}

Note: NA - not available.

(a) Exposure dose estimated assuming an adult receptor is routinely ingesting ground water.

the surface water sample collected during the investigation of LF04. Human receptors and aquatic life may be potentially exposed to the ground-water contaminants migrating via the ground water to the surface water stream. However, this exposure pathway cannot be evaluated, based on the information available to date.

6.7 RECOMMENDATIONS

The remedial investigation conducted at FT01 indicates that the use of the site as a fire protection training area has not resulted in significant soil or ground-water contamination. The metals (nickel and chromium), nitrate, and organic contamination detected in the ground water must be evaluated in light of the following:

- Organic contamination was detected infrequently. The phthalate contamination detected during the Round I sampling was not confirmed in Round II samples. The low-level volatile organic ground-water contamination is below current Federal standards.

- Nitrate concentrations in background ground-water samples are similar to those in Site FT01 ground-water samples.

- Metals concentrations above background were detected infrequently. Chromium was detected at a concentration that could affect public health in one Round II monitoring well, only. Nickel concentrations exceeded a proposed Federal MCLG; however, the risk analysis results do not predict adverse noncarcinogenic health effects under the conservative conditions used in the risk assessment.

- Metals were not detected above background in subsurface soil samples collected at the site.

- Nickel and chromium were not detected in a surface water sample taken from the unnamed creek and concentrations were background in the monitoring wells sampled during the investigation of LF04 (which encompasses FT01).

Based on the lack of significant, site-related organic or inorganic contamination, it is recommended that Site FT01 be removed from further consideration as an IRP site.

7

7.0 SITE FT02 - FIRE PROTECTION TRAINING AREA 2

7.1 SITE BACKGROUND AND HISTORY

FT02 is located within the flight line north of the municipal airport terminal and Taxiway C (Figure 7-1 and Appendix I-9) and was used as a small-scale fire protection training area from about 1968 until 1976. Typical usage consisted of one burn of off-specification oil, fuels, and solvents every 3 to 6 months. Portions of the original burn pit and the foundation of an old oil-water separator, which apparently emptied to an adjacent storm drain, still exist at the site. The site is currently covered with grass, and no visible evidence of contamination is present at the surface.

7.2 GEOLOGIC INVESTIGATION

One soil boring was drilled to a depth of 50 feet at the site at the location shown on Figure 7-1. This boring was positioned between the site and an intermittent stream, which was assumed to be in the downgradient direction. In addition, four surface soil samples were collected to a depth of 2 feet using a modified Shelby tube sampler. The Shelby tube samples all penetrated a thin layer of clayey topsoil and reddish-brown clay.

The soil boring penetrated 50 feet of clay, silt, and weathered shale. A boring log for SB601 is included in Appendix A. No moist zones or soil fractures were encountered to the depths explored, and the boring remained dry after standing open for several days. The boring was therefore abandoned and backfilled with grout.

7.3 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

7.3.1 Surface Soil

Surface-soil samples were obtained from the 0- to 2-foot interval at four locations during the investigation. The samples were collected from the center and circumference of the pit to determine the spatial distribution of potential contamination. These samples were analyzed for TCL VOCs, BNAs, PCBs, and Priority

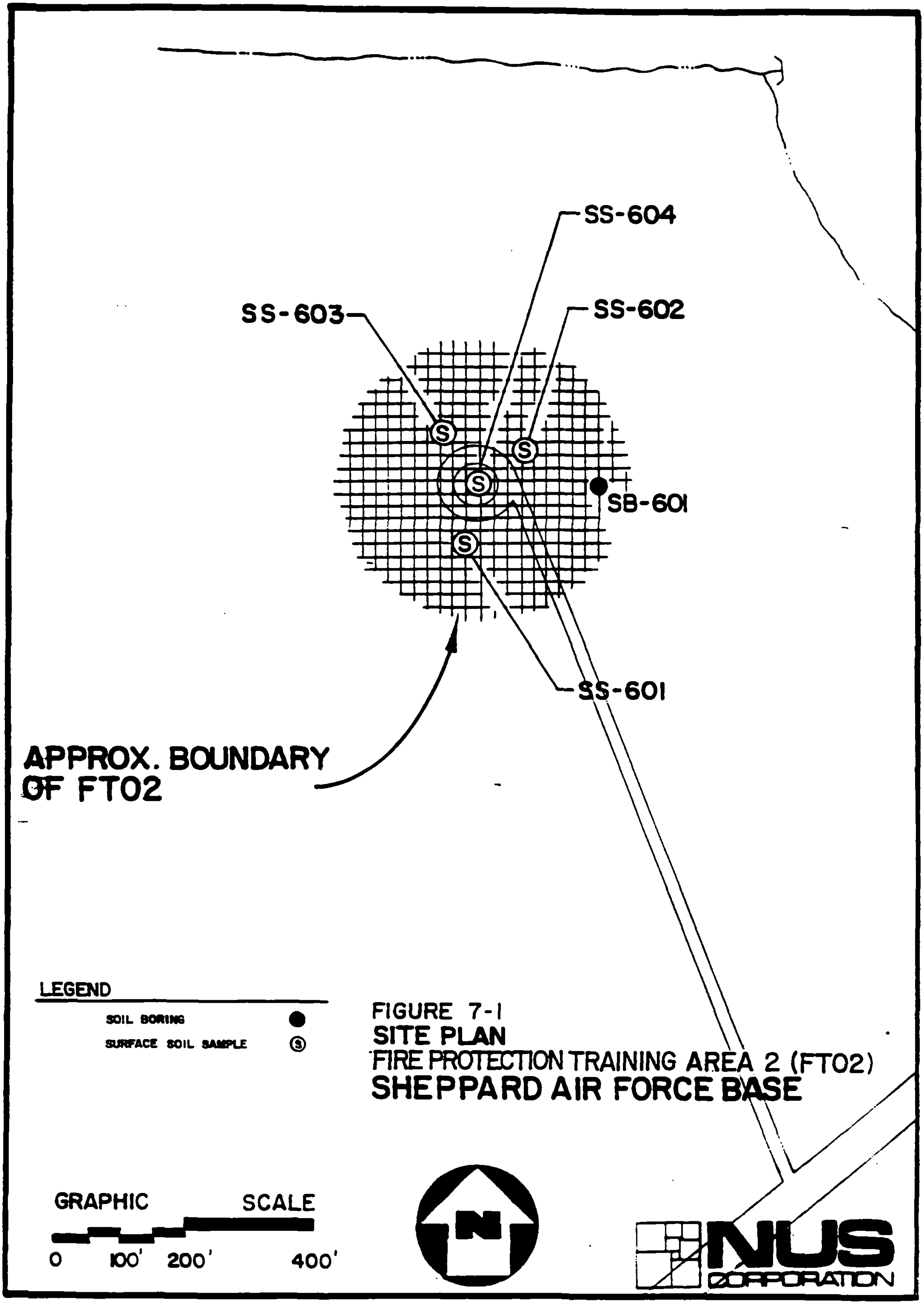


FIGURE 7-1
SITE PLAN
FIRE PROTECTION TRAINING AREA 2 (FT02)
SHEPPARD AIR FORCE BASE

Pollutant metals. Sample-specific analyses are displayed on Figure I-11 (Appendix I) and are summarized in Table 7-1. The concentrations of the metals found in the surface soils at this site are similar to background values and are less than published background concentrations for the north-central region of Texas. Organic contaminants were not detected in the surface soil samples. Because organic and inorganic contaminants were not detected in the samples, confirmatory sampling and analysis was not performed.

7.3.2 Subsurface Soil

A subsurface soil sample was collected at a depth of approximately 10 feet to determine the potential vertical extent of contamination. The soil boring was advanced to a depth of 50 feet without encountering a water-bearing zone. The sample obtained from the soil boring was analyzed for Priority Pollutant metals, CEC, TCL VOCs, BNAs, and PCBs. Analytical results are summarized in Table 7-2. Metal concentrations are similar to those reported for base background soils and indicate that previous activities did not have an impact on the environment. Organic contamination was not detected. As a result of the absence of contamination, confirmatory sampling and analysis was not performed. Sample-specific analytical results are summarized in Table 7-3 and illustrated on Figure I-11 (Appendix I).

7.4 POTENTIAL PUBLIC HEALTH RISKS

The site investigation conducted at FT02 did not reveal any evidence of soil contamination resulting from the use of the site as a fire protection training area. The shallow ground-water aquifer was not encountered during the geologic investigation conducted at the site. Consequently, quantitative risk assessment was not necessary for the site.

7.5 RECOMMENDATIONS

Based on the absence of contamination and the limited activity at this site, it is recommended that the site be removed from further consideration under the IRP.

TABLE 7-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE FT02
SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Regional Background Concentration[b]	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round I					
Arsenic (mg/kg)	2	6.5	4/4	3.4-6.1	4.7
Beryllium (mg/kg)	ND	1.5	4/4	0.85-1.1	0.99
Cadmium (mg/kg)	ND	NA[c]	1/4	1E	0.25
Chromium (mg/kg)	10.9	80	4/4	11-18E	15.8
Lead (mg/kg)	6	31.5	4/4	11.7-13.7E	12.4
Nickel (mg/kg)	27.7	37.5	4/4	9.6-16	13.4

Note: E - estimated value.
ND - Not Detected.
NA - Not Available.
(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.
(c) Dragun, 1988.

TABLE 7-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE FTO2
SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration(a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round I					
Arsenic (mg/kg)	2	6.5	1/1	4.1	4.1
Beryllium (mg/kg)	ND	1.5	1/1	1.2	1.2
Chromium (mg/kg)	10.9	80.0	1/1	22E	22
Lead (mg/kg)	6	31.5	1/1	9.84E	9.84
Nickel (mg/kg)	27.7	37.5	1/1	20	20
CEC (meq/100g)	10.6	NA	1/1	16.9	16.9

Note: E - estimated value.
ND - Not Detected.
NA - Not Available.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.

TABLE 7-3

SURFACE AND SUBSURFACE SOIL ANALYTICAL DATA
FIRE PROTECTION TRAINING AREA 2 (FT02)
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth (feet)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)
SURFACE SOIL								
SH06-SS-SS601-A	11/11/88	0-0.5	6.1	1.1	1.0E	19E	11.8E	16
SH06-SS-SS602-A	11/11/88	0-0.5	3.5	1.0	--	18E	11.7E	9.6
SH06-SS-SS603-A	11/11/88	0-0.5	3.4	--	--	11	12.5E	13
SH06-SS-SS604-A	11/11/88	0-0.5	5.9	1.0	--	15	13.7E	15
SUBSURFACE SOIL								
SH06-SU-MW601-A	11/11/88	10	4.1	1.2	--	22E	9.84E	20

Notes: E - estimated value.
(--) - analytical results below Contract Required Detection Limits (CRDLs).

8

8.0 SITE FT03 - FIRE PROTECTION TRAINING AREA 3

8.1 SITE BACKGROUND AND HISTORY

FT03 is located adjacent to the northern corner of the old municipal runway (currently Bridwell Road), and was activated in 1957 when FT01 was closed for construction of the golf course. This fire protection training area is in use at present time. The site consists of a storage area containing three, 2,000 gallon elevated fuel tanks, a concrete block building, a mock-up of a T-38 aircraft used for fire training, and a waste drainage and collection system (see Figure 8-1 and Figure I-12 [Appendix I]). The drainage and collection system was installed in 1982 and consists of drainage collection and piping leading to an oil-water separator and an unlined evaporation pond. The unburned fuel, which drains into the oil-water separator, is pumped to the storage tanks for reuse. The water phase flows to the pond, where it is then discharged to the sanitary sewer or allowed to evaporate. Present burn frequency is approximately quarterly, and approximately 300 gallons of fuel are consumed per burn. Prior to 1982, no waste collection and separation system was in operation at this site.

8.2 GEOPHYSICAL INVESTIGATION

An EM survey was conducted during the Phase II Investigation by Radian to detect and locate, to the extent possible, any contaminant migration attributable to FT03 activities. Two initial grids were set up at the site. The northern grid encompassed the active training pit and the area toward the evaporation pond. The southern grid was centered on the active evaporation pond. The dimensions of the grids are 100 feet by 200 feet and 300 feet by 200 feet, respectively. The EM survey results were inconclusive, probably as a result of interferences associated with metallic materials in the vicinity of the site.

8.3 SOIL GAS SURVEY

An NUS subcontractor conducted a soil gas survey at this site during the RI. The purpose of this effort was to detect organic contaminant plumes migrating from the site and to aid in placement of monitoring wells (if such plumes existed). Soil

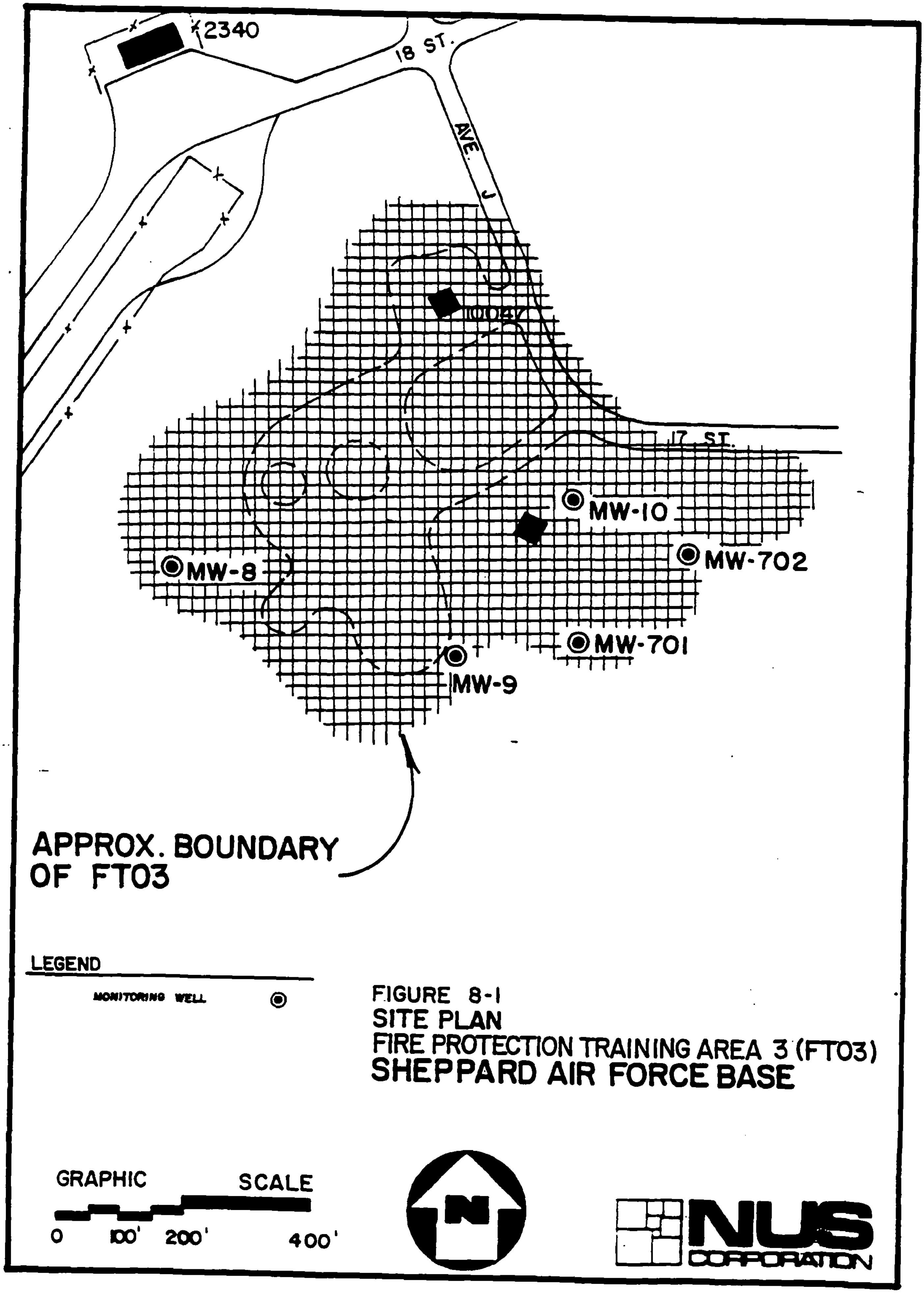


FIGURE 8-1
SITE PLAN
FIRE PROTECTION TRAINING AREA 3 (FT03)
SHEPPARD AIR FORCE BASE

gas samples were collected from one-half inch boreholes which were produced by driving a steel rod into the soil with a slide hammer. A soil gas sample was then extracted by inserting a stainless steel tube and exerting negative pressure in the hole. The soil gas sample was then prepared and shipped for laboratory analysis. The analytical results revealed no widespread contamination, but some isolated areas with low concentrations of VOCs were identified. The soil gas survey report is included as Appendix D.

8.4 HYDROGEOLOGIC INVESTIGATION

A total of five borings were drilled at the site and were subsequently completed as monitoring wells. Radian Corporation installed three wells during the initial study (Radian, 1987). NUS installed two additional downgradient wells to insure that some wells at the site were screened across the water table to intercept fuels or solvents that tend to "float" upon the water table.

Sand, silt, clay, and weathered sandstone and siltstone of the Petrolia Formation were encountered in the borings. The sand was reddish-brown, fine-grained, and clayey. Similarly, the clay and silt were reddish-brown and usually sandy. Sandstone was encountered in most of the borings ranging in depth from about 10 to 20 feet, depending on the depth of weathering. Sandstone was light brown to yellowish-brown with occasional opaque grains and green glauconite and was usually moderately soft. Siltstone was gray, sandy, thinly laminated and cross-laminated, and graded to shale with depth. Figure I-13 (Appendix I) displays the subsurface geology at the site.

Water was usually observed in most of the borings, in samples from a depth of about 25 feet. The static water level in the wells, however, was about 6 to 8 feet below the ground surface. Since there is no apparent confining layer at the site this observation may indicate that water was driven out of the core samples by drilling. However, the amount of clay matrix in the sand may produce semi-confined conditions. Ground water apparently flows southeast at the site, as shown on Figure 8-2. Hydraulic conductivity values at the site average 6.5 x 10^{-4} cm/sec, based on slug tests performed at MW-701 and MW-702.

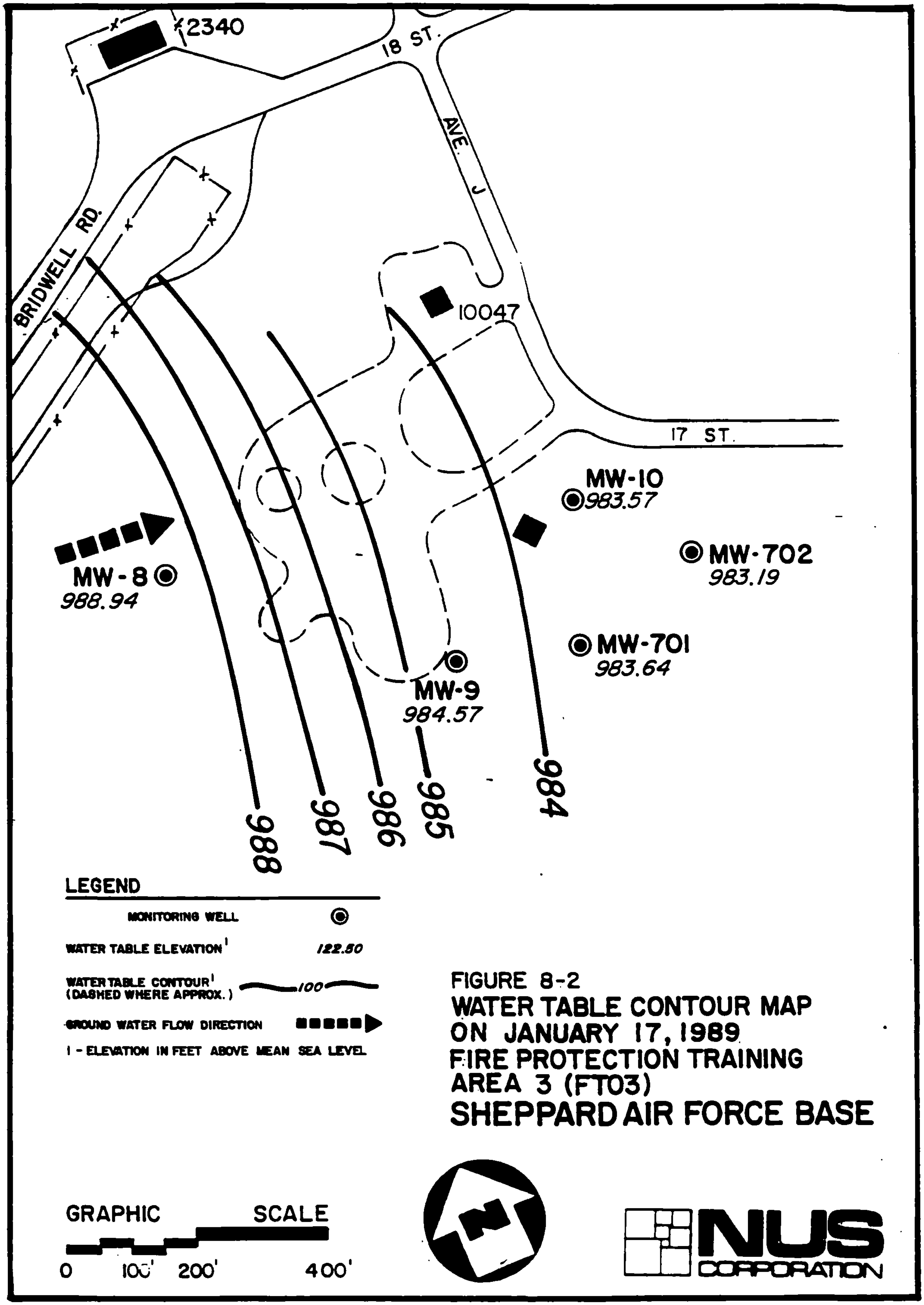


FIGURE 8-2
WATER TABLE CONTOUR MAP ON JANUARY 17, 1989 FIRE PROTECTION TRAINING AREA 3 (FT03) SHEPPARD AIR FORCE BASE

8.5 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

8.5.1 Subsurface Soil

A total of six subsurface soil samples were collected at various depths from two soil borings drilled during the investigation. These borings (SU-701 and SU-702) were later completed as monitoring wells (MW-701 and MW-702). Boring locations are shown on Figure 8-1. Based on the nature of activities at FT03, samples were analyzed for TCL VOCs, BNAs, PCBs, and Priority Pollutant metals. Sample-specific results are presented on Figure I-15 (Appendix I) and are summarized in Table 8-1.

Organic contaminants targeted by the analytical program were not detected in the subsurface soils. Generally, metals concentrations detected are similar to base or published background soil concentrations. The maximum arsenic and copper concentrations are five and ten times above base and regional background levels, respectively, but are within the range of naturally occurring arsenic and copper concentrations in soils of the United States. Arsenic concentrations of the western United States range from <0.1 to 97 mg/kg. Copper concentrations of the western United States range from 20 to 300 mg/kg, while concentrations in the eastern United States range from <1 to 700 mg/kg (Shacklette and Boerngen, 1984).

8.5.2 Ground Water

During the Round I investigation, ground-water samples were collected from three existing monitoring wells (MW-8, MW-9, and MW-10), and from two new wells (MW-701 and MW-702) installed by NUS. Additionally, one ground-water sample was obtained from MW-701 during the Round II investigation. All ground-water samples were analyzed for Priority Pollutant metals TCL VOCs, BNAs, and PCBs. Sample-specific results are displayed on Figure I-16 (Appendix I) and are summarized in Table 8-2. Organic contaminants were not detected in the ground-water samples. However, the nickel concentrations detected in MW-8 (Round I - C = 168 µg/L) and MW-701 (Round II - C = 372 µg/L) exceed the tentative MCLG (100 µg/L) currently under consideration by the EPA. The maximum chromium concentration detected in MW-701 (500 µg/L) exceeds the current Federal MCL (50 µg/L). A review of the analytical results presented on Figure I-16 (Appendix I) reveals that neither contaminant is prominent in the other monitoring wells. The nickel and chromium

TABLE 8-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE FT03 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Regional Background Concentration[b]	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round I					
Arsenic (mg/kg)	2	6.5[c]	4/6	1.3-42.4	8.8
Beryllium (mg/kg)	ND	1.5	4/6	0.6-2.2	0.7
Cadmium (mg/kg)	ND	--	2/6	2.3E-2.8E	0.9
Chromium (mg/kg)	10.9	80	6/6	8.0-56.9	26.1
Copper (mg/kg)	32.1	15	6/6	14.3-440	104
Lead (mg/kg)	6	31.5	6/6	1.8-4.3	3.1
Mercury (mg/kg)	0.4	0.04	6/6	0.10-0.30	0.18
Nickel (mg/kg)	27.7	37.5	6/6	11.7-42.1	23.9
Zinc (mg/kg)	36.2	33.5	6/6	24.6E-79.8	41.8
CEC (meq/100g)	10.6	--	1/1	9.4	9.4

Notes: ND - not detected.
-- - not reported.
E - estimated value.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.
(c) Arsenic levels in soils of the western United States range from <0.1 to 97 mg/kg. Copper levels in soils of the western United States range from 20 to 300 mg/kg. Copper levels in soils of the eastern United States range from <1 to 700 mg/kg (Shacklette and Boerngen, 1984).

TABLE 8-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE FT03 - GROUND-WATER SAMPLES - ROUND I AND ROUND II
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentration	Average Concentration	Standard/ Criteria
Round I					
Arsenic (µg/L)	ND	1/5	5.0	1.0	50[c]
Copper (µg/L)	ND	1/5	60	12	1,300[b]
Lead (µg/L)	ND	1/5	13.0E	2.6	50[c]
Nickel (µg/L)	ND	2/5	38.2-168	41.2	100[b]
Selenium (µg/L)	4.17	1/5	3.0	0.6	10[c]
Round II					
Chromium (µg/L)	ND	1/1	500	500	50[c]
Nickel (µg/L)	ND	1/1	372	372	100[b]

Note: ND - not detected.
E - estimated value.

(a) Concentration detected in MW-BB-01.
(b) Maximum Contaminant Level Goal - EPA, April 1989 unless noted otherwise.
(c) NIPDWS - National Interim Primary Drinking Water Standard.

levels detected in the ground water are considered limited evidence of the use of the site as a fire protection training area, assuming that solvents containing metallic substances were burned at FT03. However, the sporadic occurrence of these metals and the absence of widespread organic contamination indicates that the site is not a significant contaminant source. It should be noted that MW-8 is located upgradient of the operations area at FT03. Therefore, the presence of nickel in this well may not be attributable to site activities. Table 8-3 summarizes the analytical data at Site FT03.

8.6 POTENTIAL PUBLIC HEALTH RISKS

The chromium and nickel contamination sporadically detected in the FT03 monitoring wells may be evidence of the use of the site as a fire protection training area. However, organic contaminants (e.g., benzene) and lead, which are frequently found as a result of fuel/oil contamination, were not detected. Additionally, upgradient sources may be contributing to the metal contamination, as evidenced by the detection of nickel in upgradient well MW-8.

The maximum chromium and nickel concentrations detected in MW-8 and MW-701 are in excess of current/proposed Federal MCLs/MCLGs. The risk assessment results presented in the following table demonstrate that routine consumption of water containing such levels of chromium could result in adverse noncarcinogenic health effects in an adult receptor (i.e., the hazard quotient exceeds unity). The nickel concentrations detected in the ground water are not expected to cause adverse noncarcinogenic health effects:

Parameter	MCL/MCLG	Maximum Conc. at Site FT03	Hazard Quotient
Nickel	100 µg/L	372 µg/L	0.53
Chromium	50 µg/L	500 µg/L	2.9

It should be noted that chromium was detected in only one downgradient monitoring well (Round II). Furthermore, the estimated risk is for a theoretical human receptor who uses the shallow ground water as a domestic water supply source. In reality, the shallow ground water aquifer at Sheppard AFB is not currently used as a domestic water supply resource. Future use of the aquifer is unlikely

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TABLE 8-3

SUBSURFACE SOIL AND GROUND-WATER ANALYTICAL DATA
FIRE PROTECTION TRAINING AREA - 3 (FT03)
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth (feet)	Arsenic (mg/kg)	Berylium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
SUBSURFACE SOIL											
SH07-SU-SB701-A	12/07/88	4	1.6	0.6	--	42.8	42E	2.2	0.2	18.7	13.1E
SH07-SU-SB701-B	12/07/88	13	--	0.6	--	12.1	35E	1.8	0.2	11.7	24.6E
SH07-SU-SB701-C	12/07/88	17	--	0.7	--	56.9	33E	2.7	0.3	42.1	54.3E
SH07-SU-SB702-A	12/09/88	10	1.3	--	--	14.2	14.3	3.6	0.1	15.5	27.7
SH07-SU-SB702-B	12/09/88	25	7.6	--	2.3E	8	59.5	4	0.1	14.2	33.4
SH07-SU-SB702-C	12/09/88	27	42.4	2.2	2.8E	22.6	440	4.3	0.2	41.3	79 8

Sample Number	Date Sampled	Arsenic (μg/l)	Copper (μg/l)	Lead (μg/l)	Nickel (μg/l)	Selenium (μg/l)	Chromium (μg/l)
GROUND WATER							
SH07-GW-MW701-A	12/20/88	--	--	--	38.2	--	--
SH07-GW-MW009-A	11/19/88	5	60	--	--	--	--
SH07-GW-MW008-A	11/19/88	--	--	13E	168	3	--
SH07-GW-MW701-B[a]	07/14/89	--	--	--	372	--	500

Notes: E - estimated value.
(--) - analytical results below Contract Required Detection Limits (CRDLs)

[a] Round II Sampling

because the natural ground water at Sheppard AFB contains high concentrations of common anions and the aquifer has a low yield.

8.7 RECOMMENDATIONS

The remedial investigation conducted at Site FT03 indicates that the use of the site as a fire protection training area has not resulted in significant soil or ground-water contamination. The nickel and chromium contamination detected in ground water samples should be evaluated in light of the following:

- Metal concentrations above background were detected infrequently. Chromium was detected in one downgradient well, only. Metal contamination was absent from two of the three downgradient wells.

- Upgradient sources may be contributing to the presence of metals, as evidenced by the above-background nickel concentration in the upgradient well (MW-8).

- The shallow ground-water at Sheppard AFB is not currently used as a domestic water supply source, and future use is considered unlikely. Consequently, there are no potential human receptors.

The available data indicate that FT03 is not a significant source of contamination. Based on available data indicating FT03 is not a significant source of contamination, it is recommended that Site FT03 be removed from further IRP consideration.

9

9.0 SITE LF04 - LANDFILL 1

9.1 SITE BACKGROUND AND HISTORY

Site LF04 was operated from 1941 until about 1957, when it was completely closed and graded for construction of the base golf course. The landfill was approximately 100 acres in size, as shown on Figure 9-1, based on aerial photographs and interviews with base personnel (Engineering-Science, 1984). The western portion of the landfill was closed about 1952, and base housing was subsequently constructed on the area. The landfill was a trench-and-fill operation. Trenches were oriented in an east-west direction and were approximately 14 feet deep. Wastes were regularly burned at the site. The landfill accepted primarily normal base refuse, but incinerator ash, sludge from the wastewater treatment plant drying beds, and some hardfill and construction rubble were also disposed in Site LF04. Other important features of Site LF04 are the adjacent structures, which include the wastewater treatment plant, a reported low-level radioactive waste disposal well (RW07), an early fire protection training area (Site FT01), and an ordnance building. The wastewater treatment facility and radioactive waste disposal well are north of the landfill; the other structures were removed during construction of the golf course. Because most of the base's combustible liquids were used in fire protection training, it is assumed that little or no waste fuel and oil were deposited in this landfill.

9.2 HYDROGEOLOGIC INVESTIGATION

In November 1988, three borings were drilled around the perimeter of this site at the locations shown on Figure 9-1 (MW-301, MW-302, MW-303). All three borings encountered ground water and were completed as monitoring wells. The borings ranged in depth from 33 feet at MW-301 to 52 feet at MW-303, based on the depth to ground water. These wells were installed to provide ground-water samples for laboratory analyses and information on ground-water flow direction.

The geology of Site LF04 consists of reddish-brown clay and clayey silt with blue-green, fine-grained sandstone. The sandstone was encountered at depths of 20 to 30 feet in MW-301 and MW-302, and the deposit is probably continuous between

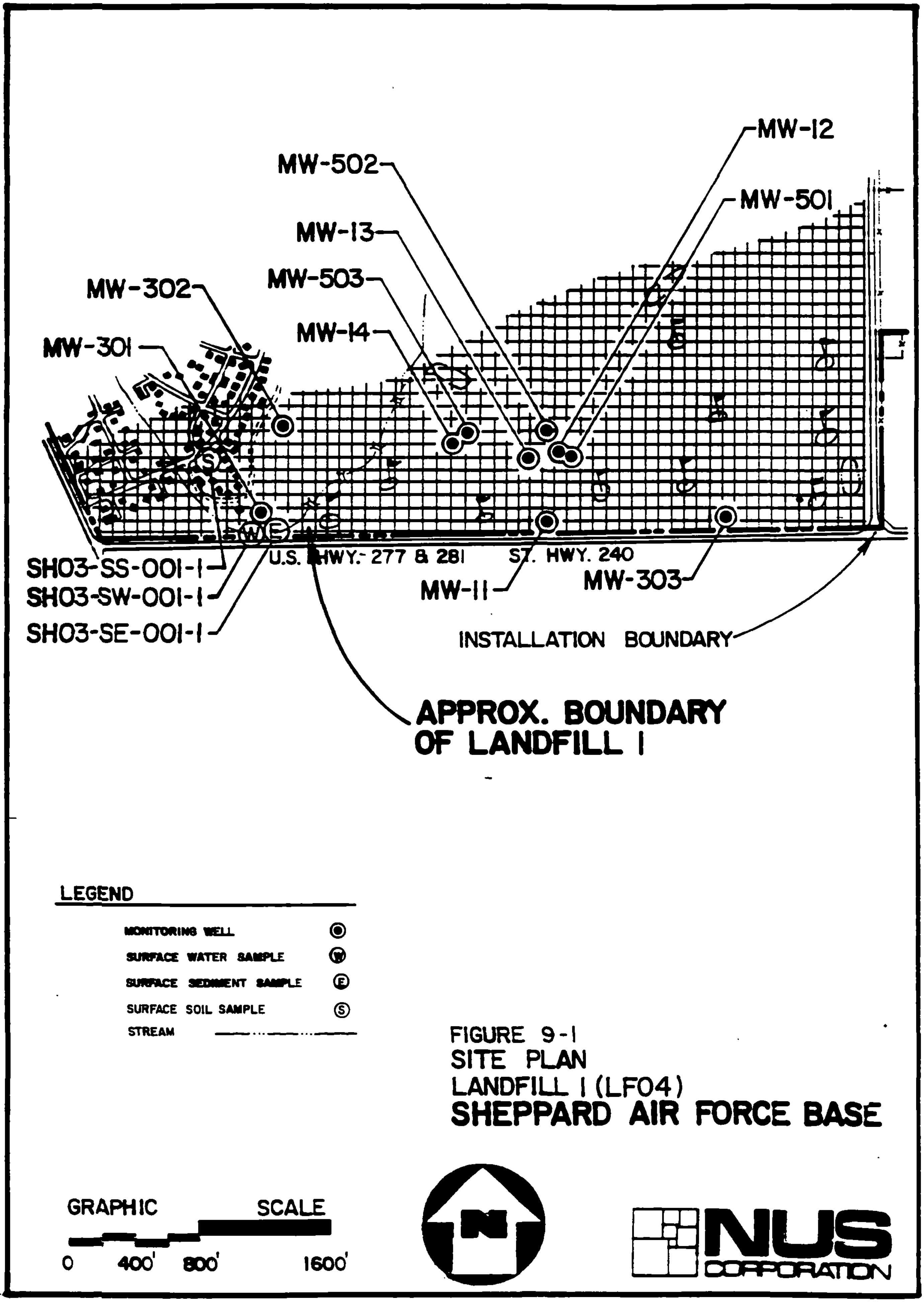

FIGURE 9-1
SITE PLAN
LANDFILL I (LF04)
SHEPPARD AIR FORCE BASE

the borings. Figure I-3 (Appendix I) shows the location of profile B-B' shown in Figure I-4, which illustrates the stratigraphy at the site. MW-303 encountered only silty clay to total depth (52 feet). The silt and clay reflect in-place weathering of the underlying shale and siltstone bedrock of the Petrolia Formation. The sandstone, being more resistant to weathering, retains its lithologic integrity but is softened somewhat by the infiltration of ground water. The shale and siltstone, being more easily weathered, have been altered to clay and silt, but some evidence of original bedding remains.

Ground water was encountered in the sandstone in both MW-301 and MW-302. The water levels in both wells rose more than 10 feet above the top of the sandstone, which suggests that ground water exists under confined conditions. The ground water in MW-303 was encountered as a seep at a depth of about 50 feet. The water level in MW-303 rose very slowly over several days to a depth of about 9 feet below ground surface, a fact that also suggests confined conditions. Ground water apparently moves through the clay in fractures or other inherent weaknesses in the soil. The ground water at MW-303 is also apparently under confining pressure, but the confining layer is not as well-defined as the sandstone that is present in the other two wells.

Ground-water flows in a southerly direction in the vicinity of MW-301 and MW-302, which mimics the direction of the surface water flow in the neighboring stream [Figure I-5 (Appendix I)]. The ground water at MW-303 appears to be unrelated to the system at MW-301 and MW-302. Ground water at MW-303 probably flows to the east, generally following topography.

Slug tests conducted at MW-301, MW-302, and MW-303 yielded hydraulic conductivity values of 7.7×10^{-5} cm/sec, 6.9×10^{-4} cm/sec, and 6.4×10^{-5} cm/sec, respectively. The hydraulic conductivity at MW-303 is the lowest at the site, as anticipated-based on the silty clay lithology and the sluggish infiltration of ground water into the well after completion.

9.3 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

9.3.1 Surface Soils

One surface soil sample was taken during the Round 1 of the investigation and analyzed for Priority Pollutant metals, TCL VOCs, BNAs, and PCBs. The sample was taken from an area near base housing to evaluate the possibility of surface contamination affecting public health. A review of the chromatograms for the PCB analyses indicated the possibility of pesticide contamination in the area. Because these analyses were not subject to second-column confirmation, the pesticide identification and quantification were tentative. Four additional surface soil samples were collected (Round II) and analyzed for TCL pesticides and pH. One of these soil samples was also analyzed for TOC. All sampling locations are depicted on Figure I-3. Sample-specific analytical results are displayed on Figures I-6 and I-7 (Appendix I) and summarized in Table 9-1.

The analytical results presented on Table 9-1 indicate that landfilling activities at Site LF04 have not affected surface soil. The concentrations of metals detected are generally similar to base or published background values. The following pesticides were detected during the investigation:

- Delta-BHC (C_{max} = 17 µg/kg)
- Heptachlor (C_{max} = 200 µg/kg)
- 4,4'-DDT (C_{max} = 85 µg/kg)
- 4,4'-DDE (C_{max} = 170 µg/kg)
- Dieldrin (C_{max} = 150 µg/kg)
- Gamma-chlordane (C_{max} = 270 µg/kg)

No source of the low-level pesticide contamination was identified during the investigation. However, the concentrations and types of pesticides detected suggest that the contamination may be the result of past insecticide application at Sheppard AFB.

9.3.2 Subsurface Soils

One subsurface soil sample was collected from each of three monitoring wells installed at LF04. Samples from soil borings SU-MW-301, 302, and 303 were collected at a depth of 5 feet to examine soil affected by prior landfilling practices. The samples were analyzed for TCL VOCs, BNAs, and PCBs as well as Priority Pollutant metals. In addition, one soil sample was analyzed for CEC. Sample locations are shown on Figure I-3 (Appendix I). Sample-specific analytical results are displayed on Figure I-6 and are summarized in Table 9-2. No organic compounds were detected in

R34892

TABLE 9-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF04 - SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration(a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round I					
Arsenic (mg/kg)	2	6.5	1/1	1.9	1.9
Beryllium (mg/kg)	ND	1.5	1/1	0.9	0.9
Chromium (mg/kg)	10.9	80.0	1/1	35.7	35.7
Copper (mg/kg)	32.1	15.0	1/1	26.2E	26.2
Lead (mg/kg)	6	31.5	1/1	31.8	31.8
Mercury (mg/kg)	0.4	0.04	1/1	0.3	0.3
Nickel (mg/kg)	27.7	37.5	1/1	30.5	30.5
Zinc (mg/kg)	36.2	33.5	1/1	60.3E	60.3

TABLE 9-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF04 - SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration(a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round II					
Delta-BHC (µg/kg)	ND	NA	1/4	17.0	4.3
Heptachlor (µg/kg)	ND	NA	1/4	200.0	50
4,4'-DDT (µg/kg)	ND	NA	4/4	36-85.0	57
4,4'-DDE (µg/kg)	ND	NA	4/4	19.0-170.0	84.25
Dieldrin (µg/kg)	ND	NA	1/4	150.0	37.5
Gamma-chlordane (µg/kg)	ND	NA	2/4	100-270.0	925
pH	NA	NA	4/4	5.6-7.5	6.7
TOC (mg/kg)	NA	NA	1/1	15,000	15,000

Notes: NA - not available/not analyzed.
ND - not detected.
E - estimated value.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.

TABLE 9-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF04 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Regional Background Concentration[b]	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round I					
Arsenic (mg/kg)	2	6.5	3/3	1.67-3.56	2.5
Beryllium (mg/kg)	ND	1.5	3/3	1.0-2.4	1.5
Chromium (mg/kg)	10.9	80.0	3/3	29.0-34.0	31.7
Lead (mg/kg)	6	31.5	3/3	4.1-5.7	5.0
Nickel (mg/kg)	27.7	37.5	3/3	30.0-37.0	34.3
Zinc (mg/kg)	36.2	33.5	3/3	54.0-80.0	63.3
CEC (meq/100g)	10.6	NA	1/1	38.8	38.8

Notes: NA - not available.
ND - not detected.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984).

the subsurface soil. The concentrations of inorganics are similar to background levels for this region of the United States.

9.3.3 Surface Water/Sediment

Duplicate surface water and sediment samples were collected from an area where the unnamed creek flows through the boundary of the base golf course. The samples were analyzed for TCL VOCs, BNAs, and PCBs, and Priority Pollutant metals. Additionally, the surface water samples were analyzed for the common anions and TDS. Sample-specific analytical results are displayed on Figures I-6 and I-8 (Appendix I) and summarized in Table 9-3. No organic contaminants were detected in the surface water or sediment samples collected at LF04. Generally, the concentrations of metals detected in the sediments are similar to base or published background soil values. Chromium, zinc, and lead are present at five to ten times the concentrations detected in the background soil samples, but are similar to regional background levels or are within the range reported for soils of the western United States. Lead levels in soils of the western United States range from <10 to 700 mg/kg. Chromium levels in soils of the western United States range from 3 to 2,000 mg/kg. Zinc levels in soils of the western United States range from 10 to 2,100 mg/kg (Shacklette and Boerngen, 1984). These metals were not detected at elevated concentrations in site soils, surface waters, or ground waters. Four metals (antimony, arsenic, silver, and zinc) were detected in one of the duplicate surface water samples. The metals concentrations exceed the MCLG for antimony (3 µg/L) and the MCL for arsenic (50 µg/L); however, these metals were not detected in the duplicate sample.

9.3.4 Ground Water

Ground-water samples were collected from two of three monitoring wells (MW-301 and MW-302) installed at Site LF04. Round 1 ground-water samples were analyzed for TCL VOCs, BNAs, and PCBs, as well as the Priority Pollutant metals and cyanide. The sample from MW-301 was also analyzed for TDS and the common anions. Round II ground-water samples were analyzed for Priority Pollutants metals, radium-226, and radium-228. Sample-specific analytical results are shown on Figure I-8 (Appendix I) and summarized in Table 9-4. Bis(2-ethylhexyl)phthalate (3 µg/L) was the only organic contaminant detected in site ground water and was not detected in

TABLE 9-3

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF04 - SURFACE WATER/SEDIMENTS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentrations	Average Concentrations	Standard/ Criteria
Round I - Sediment					
Arsenic (mg/kg)	2	2/2	2.6-2.9	2.75	NA
Beryllium (mg/kg)	ND	1/2	1.1	0.55	NA
Chromium (mg/kg)	10.9	2/2	68.9-77.2	73.0	NA
Copper (mg/kg)	32.1	2/2	44E-51.4E	47.7	NA
Lead (mg/kg)	6	2/2	78-120	99.0	NA
Mercury (mg/kg)	0.4	2/2	1.1-1.4	1.25	NA
Nickel (mg/kg)	27.7	2/2	24.8-36.4	30.6	NA
Silver (mg/kg)	ND	2/2	2.3E-2.7E	2.5	NA
Zinc (mg/kg)	36.2	2/2	110E-130E	120	NA
Round I - Surface-Water					
Antimony (µg/L)	ND	1/2	66.3E	32.2	3[e]
Arsenic (µg/L)	ND	1/2	74.6	37.3	50[b]
Silver (µg/L)	ND	1/2	7.8E	3.9	50[b]
Zinc (µg/L)	ND	1/2	128E	6.4	5,000[c]
Cyanide (µg/L)	ND	2/2	17.5-80.0	48.75	200[e]
TDS (mg/kg)	796	2/2	431-460	445.5	500[c]
Chloride (mg/kg)	90.7	2/2	147-150	148.5	250[c]

R34892

TABLE 9-3

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF04 - SURFACE WATER/SEDIMENTS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentrations	Average Concentrations	Standard/ Criteria
Round II - Surface-Water (continued)					
Nitrate (mg/L)	ND	2/2	0.3-0.4	0.35	1[d]
Sulfate (mg/L)	62.4	2/2	47.9-53.6	50.75	250[c]
Fluoride (mg/L)	0.82	2/2	2.2-2.3	2.25	4[d]
Bromide (mg/L)	0.5	2/2	0.57-0.74	0.65	NA
Orthophosphate (mg/L)	ND	2/2	15-16	15.5	NA
Total phosphate (mg/L)	ND	2/2	4.81-4.98	4.89	NA

Notes: NA - not available.
ND - not detected.
E - estimated value.

(a) Average of two subsurface soils/one ground-water sample(s) collected on the base, not near any IRP site.
(b) NIPDWS - National Interim Primary Drinking Water Standard.
(c) Secondary Drinking Water Standard.
(d) 40 CFR Parts 141, 142 and 143 (May 1989).
(e) USEPA, October 1989.

TABLE 9-4

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF04 - GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration	Number Detections/ Number Samples	Range of Concentrations	Average Concentration	Standard/ Criteria
Round I					
Bis(2-ethylhexyl) phthalate (µg/L)	ND	1/2	3	1.5	NA
Copper (µg/L)	ND	1/2	164	82	1,300[a]
Selenium (µg/L)	4.17	1/2	5.82	2.9	10[c]
Chloride (mg/L)	90.7	1/1	617	617	250[b]
Nitrate (mg/L)	65.9	1/1	0.26	0.26	10[c]
Sulfate (mg/L)	62.4	1/1	291	291	250[b]
Fluoride (mg/L)	0.82	1/1	2.1	2.1	4[e]
Bromide (mg/L)	0.5	1/1	2.9	2.9	NA
TDS (mg/L)	796	1/1	2,914	2,914	500[b]
Zinc (µg/L)	ND	1/2[d]	102-104	103	5,000[b]

R34892

TABLE 9-4

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF04 - GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration	Number Detections/ Number Samples	Range of Concentrations	Average Concentration	Standard/ Criteria
Round II					
Arsenic	ND	2/5	5.9-20.3	13.1	50(c)
Nickel	ND	1/5	26	26.0	100(a)
Radium 226	ND	1/5	3.5	3.5	5(c)
Radium 228	1.8 ± 0.7	3/5	2.2-4.4	3.5	5(c)

Note: ND - not detected.
NA - not applicable

(a) USEPA, October 1989.
(b) Secondary Drinking Water Standard.
(c) Primary Drinking Water Regulation advisory.
(d) Zinc results were reported for sample (and duplicate) from MW-302.
(e) Federal SDWA Primary MCL.

any other environmental media sampled at the site. Metals concentrations (copper, nickel, selenium, and arsenic) were below MCLs/MCLGs. However, the chloride, sulfate, and TDS concentrations reported for MW-301 exceed Secondary Drinking Water Standards, which are based on aesthetic considerations, only. The combined radium 226/228 activity for one Round II ground-water sample marginally exceeds the Primary Drinking Water Standard of 5pCi/L. Radium 226/228 activities in the duplicate sample did not exceed the standard. The radiological activities at Site LF04 probably reflect base background conditions. Tables 9-5, 9-6, and 9-7 summarize the analytical data at Site LF04.

9.4 POTENTIAL PUBLIC HEALTH RISKS

This section discusses the potential public health risks estimated for human exposure to selected indicator compounds detected in the various environmental media at Site LF04. The risk assessment methodology used to calculate exposure doses and risks is presented in Section 4.0.

Surface Soil Exposures

As presented in Section 7.3, surface soil and sediment samples collected at Site LF04 show minimal evidence of landfill-related contamination. Generally, the metals concentrations are similar to those in base and/or regional background samples. The pesticides detected in the Round II surface soil samples are probably the result of historical pesticide use at Sheppard AFB. Because residential housing now exists in one section of the area that was previously included in the landfill, this risk assessment will consider risks to residents as a result of exposure to pesticides detected in the surface soils. The following indicator compounds are evaluated:

- Delta-BHC
- Heptachlor
- 4,4'-DDT
- 4,4'-DDE
- Dieldrin
- Gamma-chlordane

The Hawley Model discussed in Section 4.5 (page 4-31) was used to estimate risks to individuals now residing in this area of the landfill. The risk assessment results

TABLE 9-5

SURFACE AND SUBSURFACE SOIL ANALYTICAL DATA
LF04 - LANDFILL 1
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth (feet)	Arsenic (mg/kg)	Beryllium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)
SUBSURFACE SOIL											
SH03-SU-SB301-A	11/12/88	10	3.56	1.1	32	--	4.1	--	37	--	56
SH03-SU-MW303-A	11/13/88	12	2.38	2 4	34	--	5.7	--	36	--	54
SH03-SU-MW302-A	11/13/88	11	1.67	1.0	29	--	5.4	--	30	--	80
SURFACE SOIL											
SH03-SS-001-1	12/07/89	0-0.05	1.9	0.9	35.7	26.2	31.8	0.3	30.5	--	60.3
SEDIMENT											
SH03-SE-001-1	12/07/89	0-0.5	2.6	--	77.2	44E	78.1	1.1	36.4	2.3E	110E
SH03-SE-001-10	12/07/89	0-0.5	2 9	1.1	68.9	51.4E	120	1.4	24.8	2 7E	130E

Note: (--) - analytical results below Contract Required Detection Limits (CRDLs).
E - Estimated value.

R34892

TABLE 9-6

GROUND-WATER AND SURFACE-WATER ANALYTICAL DATA
LF04 - LANDFILL 1
SHEPPARD AIR FORCE BASE, TEXAS

GROUND WATER

Sample Number	Date Sampled	Arsenic (µg/l)	BEHP[(a)] (µg/l)	Bromine (mg/l)	Chloride (mg/l)	Copper (µg/l)	Fluoride (mg/l)	Nickel (µg/l)	Nitrate (mg/l)	Selenium (µg/l)	Sulfate (mg/l)	TDS (mg/l)	Zinc (µg/l)
SH03-GW-MW301-A	11/17/88	--	--	2.9	617.0	--	2.1	--	0.26	5.82	291.0	2,914	--
SH03-GW-MW302-A	11/15/88	--	--	NA	NA	--	NA	--	NA	--	NA	NA	102
SH02-GW-MW302-A	12/18/88	--	3E	NA	NA	164E	NA	--	NA	--	NA	NA	--
SH03-GW-MW302-X	11/15/88	--	--	NA	NA	--	NA	--	NA	--	NA	NA	104
SH03-GW-MW301-C	07/17/89	20.3	--	NA	NA	--	NA	26	NA	--	NA	NA	--
SH03-GW-MW302-C	07/17/89	5.9	--	NA	NA	--	NA	--	NA	--	NA	NA	--

SURFACE WATER

Sample Number	Date Sampled	Antimony (µg/l)	Arsenic (µg/l)	Bromine (mg/l)	Chloride (mg/l)	Cyanide (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Phosphate as Phosphorous (mg/l)	Silver (µg;l)	Sulfate (mg/l)	TDS (mg/l)	Total Petroleum Hydrocarbons (mg/l)	Zinc (µg/l)
SH03-SW001-1	12/07/89	--	74.6	0.74	150.0	80.3	2.2	0.4	16.0	--	53.6	431	4,980	--
SH03-SW001-1D	12/07/89	66.3	--	0.57	147.0	17.5	2.3	0.3	15.0	7.8	47.9	460	4,810	128

(a) Bis(2-ethylhexyl)phthalate.

Notes: (--) - analytical results below Contract Required Detection Limits (CRDLs)
E - estimated value.
NA - Not analyzed for this parameter.
Samples taken for radiological background from this site are not included in this table.

TABLE 9-7

PESTICIDE CONCENTRATIONS IN SURFACE SOILS[a]
LF04 - LANDFILL 1
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Delta BHC (µg/kg)	DDT (µg/kg)	DDE (µg/kg)	Dieldrin (µg/kg)	Heptachlor (µg/kg)	Chlordane (µg/kg)
SH03-SS-SS304-A	07/12/89	17	36	19	--	--	--
SH03-SS-SS305-A	07/12/89	--	85	170	150	--	100
SH03-SS-SS306-A	07/12/89	--	49	67	--	--	--
SH03-SS-SS307-A	07/12/89	--	58	81	--	200	270

Note: (--) - analytical results below Contract Required Detection Limits (CRDLs).

(a) Round II sampling.

presented in Table 9-8 indicate that even when maximum contaminant concentrations are evaluated (the worst-case scenario), the incremental cancer risk estimated for an individual who resides all of his/her life in this area is 2.9×10^{-6}. The risk is below 1×10^{-6} when average contaminant concentrations are evaluated (the plausible-case scenario). The Hazard Index, calculated as an indicator of noncarcinogenic risk, never exceeds unity. Thus, adverse noncarcinogenic health effects would not be anticipated under the exposure conditions established in the risk assessment.

Surface Water/Sediment Exposures

The analytical results presented in Section 9.3 indicate that there is little evidence of landfill-related contamination in the surface water or sediments of the unnamed creek passing through Site LF04. However, chromium, lead, and zinc levels were detected in the sediments at concentrations five to ten times those found in background soil samples, and arsenic and antimony were detected in one of the duplicate surface water samples. This unnamed creek is not used as a water supply source, and it is not suitable for recreational activities; therefore, it is unlikely that human receptors would be affected by metals in the surface waters. However, residents (e.g., adolescents) from the adjoining housing complex (trespassing across the site) or base personnel working in the area may occasionally come in contact with the sediments. In worst-case exposure scenario, a resident would contact the sediments and subsequently ingest a small amount of the sediments adhering to his/her hands, as a result of hand-to-mouth contact. Table 9-9 summarizes the results of the risk assessment, assuming that a resident from the neighboring housing complex is frequently exposed to the sediments of the unnamed creek. The risk assessment results indicate that adverse noncarcinogenic health effects would not be anticipated under the defined exposure scenarios.

In summary, the risk assessment results presented in tables 9-8 and 9-9 indicate that the pesticides detected in the surface soils of Site LF04 result in incremental cancer risks below 1×10^{-6} when the reasonable (plausible) case exposure scenario is evaluated; adverse noncarcinogenic health risks are not anticipated. Also, adverse health effects are not predicted for residents (or base personnel) who contact surface waters or sediments of the creek.

TABLE 9-8

SUMMARY OF RISK ASSESSMENT RESULTS
PESTICIDE EXPOSURE - RESIDENTIAL SETTING-SITE LF04
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Incremental Cancer Risk		Hazard Index	
Maximum Contaminant Concentrations (Worst-Case Scenario)	Average Contaminant Concentrations[a] (Plausible-Case Scenario)	Maximum Contaminant Concentrations	Average Contaminant Concentrations[1]
2.9×10^{-6}	8.4×10^{-7}	1.4×10^{-1}	4.2×10^{-2}

(a) Arithmetic average contaminant levels calculated using zero for non-detects.

TABLE 9-9

SUMMARY OF RISK ANALYSIS RESULTS
METALS EXPOSURE - NONRESIDENTIAL SETTING-SITE LF04
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Hazard Quotient			
	Maximum Contaminant Concentration (Worst-Case Scenario)		Average Contaminant Concentrations (Plausible-Case Scenario)	
	Adult Receptor	Adolescent Receptor	Adult Receptor	Adolescent Receptor
Chromium	8.0×10^{-3}	5.0×10^{-3}	7.0×10^{-3}	5.0×10^{-3}
Lead	4.2×10^{-2}	2.7×10^{-2}	3.5×10^{-2}	2.2×10^{-2}
Zinc	3.0×10^{-4}	2.0×10^{-4}	2.9×10^{-4}	2.0×10^{-4}

9.5 RECOMMENDATIONS

The remedial investigation conducted at Site LF04 indicates that landfilling activities have not resulted in significant soil, surface water, sediment, or ground-water contamination. The only organic compounds detected were low concentrations of pesticides in site surface soils that appear to reflect past pesticide applications. The risk assessment results do not indicate that the pesticides present a significant health risk. An evaluation of metals detected in site sediments above site background soil concentrations indicates that the levels do not present a significant health risk to base personnel or the resident occasionally trespassing across the site. The metals concentrations and radiological activities detected in site ground water samples appear to reflect background conditions. Based on the lack of significant contamination at Site LF04, no further action is recommended.

10

10.0 SITE LF05-LANDFILL 2

10.1 SITE BACKGROUND AND HISTORY

Site LF05 is a rectangular-shaped area of approximately 7 acres located south of the present municipal airport complex (Figures 10-1 and I-9 [Appendix I]). The landfill was operated for about 3 years during the early 1960s. Landfill operations consisted of trench-and-fill procedures; trenches ran east-west and were approximately 10 to 14 feet deep. Based on available information, only normal base refuse was disposed of in Landfill 2. Burning of the refuse was performed during the period of use. At the present time, the landfill area is covered with native vegetation and is used as a Medical Readiness Training Area.

10.2 HYDROGEOLOGIC INVESTIGATION

Field work was conducted at this site in November 1988 and July 1989. Round I of the investigation involved drilling three borings at the locations shown on Figure 10-1. Ground water was encountered in two of these borings, and monitoring wells were installed. The third boring (SB-203) was left open for several months, and no appreciable ground water entered the boring. SB-203 was therefore backfilled with grout. A fourth boring (SB-204) was drilled and a monitoring well was installed during Round II of the investigation to provide additional ground-water information. Boring depths ranged from 33 feet at MW-204 to 55 feet at MW-202. Figure I-10 (Appendix I) shows a subsurface profile through this area. The location of profile A-A' is indicated in Figure I-9 (Appendix I).

The borings at LF05 penetrated soil and weathered bedrock of the Petrolia Formation. The soil consisted of clayey sand, clay, and silt derived from in-place weathering of the underlying bedrock. Sand or sandstone was encountered in all borings at the site, at depths ranging from the surface at MW-204 to 41 feet at MW-202. As illustrated in Figure I-10 (Appendix I), an upper sandstone unit appears to be interconnected between MW-201 and MW-204, but this upper unit is not present at MW-202, which is screened in a lower sandstone unit. The lower sandstone unit was lithologically identical to the upper unit, but apparently is not stratigraphically connected to it.

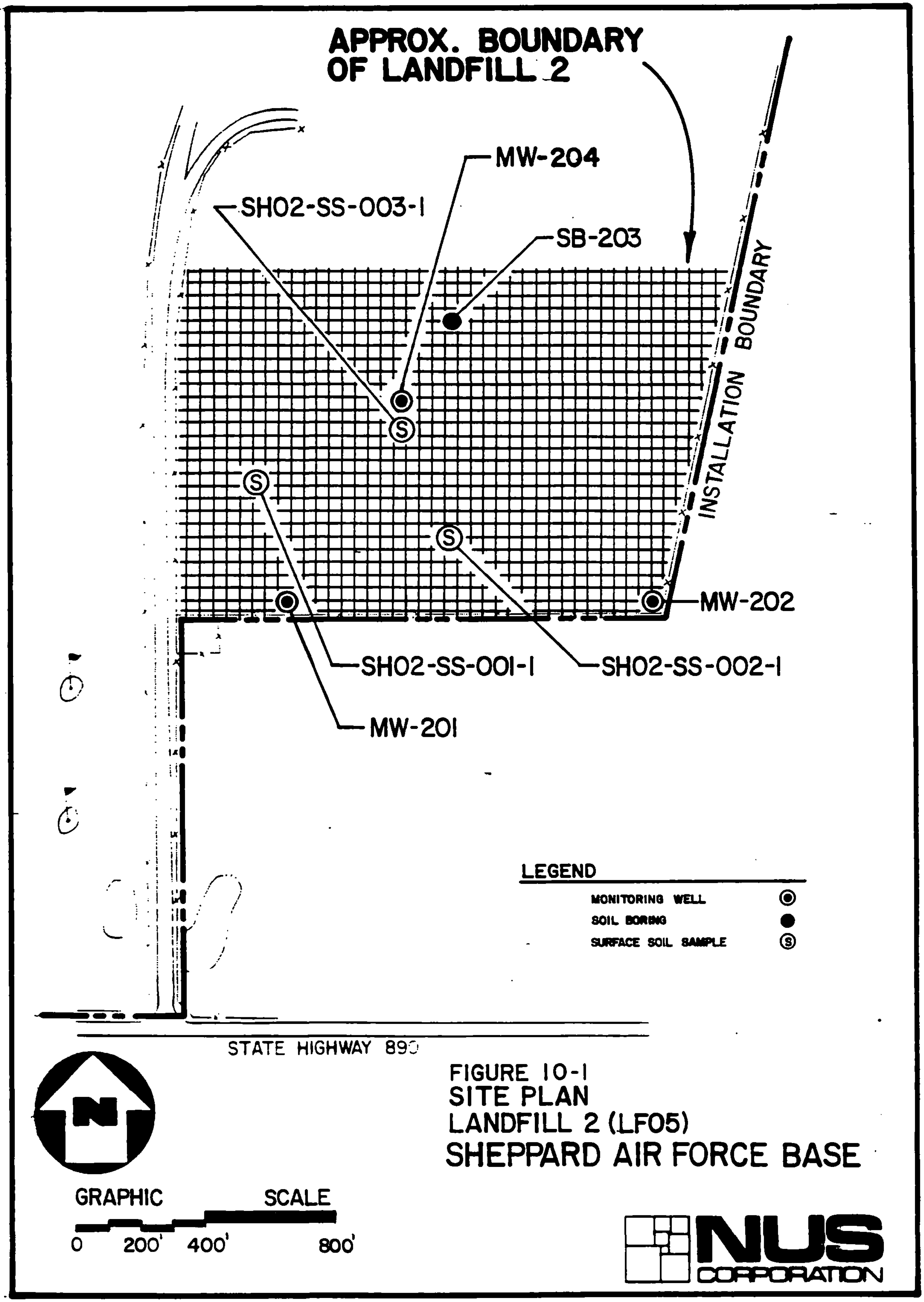

FIGURE 10-1
SITE PLAN
LANDFILL 2 (LF05)
SHEPPARD AIR FORCE BASE

Ground water was generally associated with the sandstone units. Evidently, the shallow sandstone at SB-203, while in the same stratigraphic horizon as the sandstone encountered in SB-201 and SB-204, was situated above the saturated zone. Ground water was found at depths of about 13 feet at MW-201 and MW-204 and 38 feet at MW-202, which suggests that these water-bearing zones are unrelated. Since only two wells are screened within the same water-bearing zone, an accurate assessment of ground-water flow direction cannot be established (Figure 10-2). However, ground-water flow probably mimics the surface topography at the site and flows toward the south, generally toward the Wichita River. Based on the water levels in MW-201 and MW-204 and their disparity with MW-202, net ground-water flow is downward; that is, ground water in the upper unit may replenish the lower water-bearing zone.

Slug tests conducted at MW-201 and MW-202 yielded hydraulic conductivity values of 7.2×10^{-4} cm/sec and 7.3×10^{-5} cm/sec, respectively. Therefore, lateral ground-water flow is potentially more rapid within the shallow water-bearing sandstone unit (MW-201 and MW-204) than in the deeper sandstone (i.e., at MW-202). This may be attributable to greater transmissivity in the upper unit as a result of a more pervasive weathering closer to the surface.

10.3 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

10.3.1 Surface Soil

As part of the Round I investigation in 1988, three surface soil samples (SS-001 through SS-003) were collected. Surface soil samples were analyzed for TCL VOCs, BNAs, PCBs, and Priority Pollutant metals. Laboratory analysis for PCBs revealed the possible presence of pesticide contamination in the PCB chromatograms. However, these analyses were not subjected to second-column GC confirmation; therefore, the identification and quantification of the pesticides were considered inconclusive. Consequently, as part of the Round II investigation, 13 surface soil samples (including one field duplicate) were obtained to determine whether pesticide contamination existed. Sample locations are indicated on Figure I-11 (Appendix I).

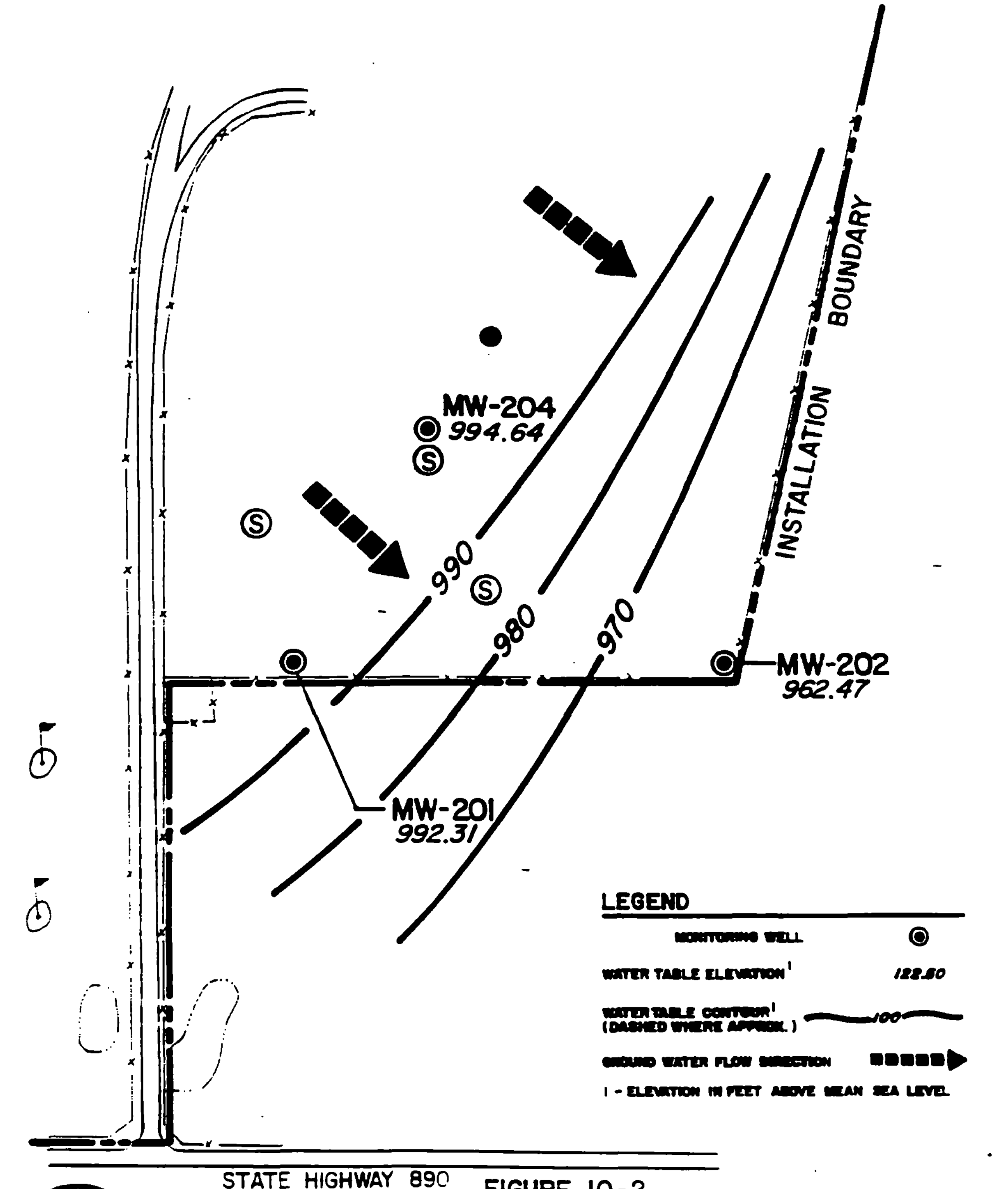

FIGURE 10-2
WATER TABLE CONTOUR MAP
ON JULY 19-20, 1989
LANDFILL 2 (LF05)
SHEPPARD AIR FORCE BASE

GRAPHIC SCALE
0 200' 400' 800'

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Sample-specific analytical results for the Round I and II investigations are shown on Figure I-11 (Appendix I) and are summarized in Table 10-1. Bis(2-ethylhexyl)phthalate (60 to 100 µg/kg) was found in every surface soil sample collected. This compound was in a background sample at a similar concentration (80 µg/kg). During the Round II sampling, DDE was detected in one surface soil sample (SS-205A) at a concentration of 25 µg/kg. The detection of DDE may be a result of past insecticide application in the area or from regional fallout. No other organic contaminants were detected during either surface soil sampling round conducted at this site. The concentrations of inorganics detected in the surface soil samples are not indicative of contamination at LF05. As shown in Table 10-1, inorganic concentrations are generally comparable to literature and/or base background soil concentrations. The complete analytical data base is presented in Appendix G.

10.3.2 Subsurface Soil

A total of four subsurface soil samples (including one duplicate) were collected during Round I to investigate soil contamination below the surficial soils. Two additional samples were collected to better define the limits of contamination. Sampling points were selected based on the locations of trenches observed in aerial photographs. Trench locations were confirmed from field reconnaissance. All subsurface soil samples were analyzed for TCL VOCs, BNAs, PCBs, and Priority Pollutant metals. In addition, two Round I subsurface soil samples were analyzed for CEC, and two Round II subsurface soil samples were analyzed for TOC.

Sample-specific analytical results for the Round I and II investigations are displayed on Figure I-11 (Appendix I) and are summarized in Table 10-2. The sample analyses indicate that disposal practices at the landfill have not resulted in significant subsurface soil contamination. Organic contaminants were not detected, and generally, inorganic concentrations detected are similar to or less than background levels normally found in this region of the United States. Only antimony (C = 11.1 mg/kg) was detected above base and regional background levels. Native soil concentrations of antimony may range as high as 10 mg/kg (Dragun, 1988).

R34892

TABLE 10-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF05 - SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base[a] Background	Regional[b] Background	No. Detects/ No. Samples	Range (units)	Avg. (units)
Round I					
Bis(2-ethylhexyl) phthalate µg/kg	80 µg/kg	NA	3/3	60-100	76.6
Arsenic mg/kg	2	6.5	3/3	1.7E-3.5	2.7
Chromium mg/kg	10.9	80.0	3/3	7.5E-63.5E	28.7
Copper mg/kg	32.1	15.0	3/3	15.4E-38E	23.5
Lead mg/kg	6	31.5	3/3	0.92-21.9	13.44
Mercury mg/kg	0.4	0.04	3/3	0.3-0.3	0.3
Nickel mg/kg	27.7	37.5	1/3	12.2	4.1
Zinc mg/kg	36.2	33.5	3/3	22.1-35.5	27.9
Round II					
4,4'-DDE µg/kg	ND	NA	1/13	25	1.9
pH	NA	NA	13/13	6.1-8.3	7.5
TOC mg/kg	NA	NA	1/1	10,000	10,000

Note: E - estimated value.
NA - not available.
ND - Not detected.

(a) Base background concentrations are from subsurface soils taken on the base but away from any IRP site.
(b) Published values for background concentrations of surface soils (Shacklette and Boerngen, 1984).

TABLE 10-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF05 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration(a)	Regional Background Concentration(b)	Number Detection/ Number Samples	Range of Concentrations	Average Concentrations(d)
Round I					
Arsenic (mg/kg)	2	6.5	4/4	1.2-2.57	1.86
Beryllium (mg/kg)	ND	1.5	4/4	0.52-1.4	0.8
Chromium (mg/kg)	10.9	80.0	4/4	14.0-26.0	20.75
Lead (mg/kg)	6	31.5	4/4	6.2E-12.6E	6.8
Nickel (mg/kg)	27.7	37.5	4/4	16.0-24.0	20.25
Zinc (mg/kg)	36.2	33.5	2/4	55.0-65.0	30
CEC (meq/100g)	10.6	NA	2/2	5.4-7.6	6.5
Round II					
Antimony (mg/kg)	ND	1.0	1/2	11.1E	5.6
Arsenic (mg/kg)	2	6.5	2/2	1.5E-4.4E	2.95
Beryllium (mg/kg)	ND	1.5	2/2	0.43-0.54	0.48
Cadmium (mg/kg)	ND	0.02-7.0(c)	1/2	0.97	.5
Chromium (mg/kg)	10.9	80.0	2/2	11.4-14.2	12.8
Copper (mg/kg)	32.1	15.0	2/2	5.5-6.7	6.1
Lead (mg/kg)	6	31.5	2/2	7.5E-39.4E	23.45

R34892

TABLE 10-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF05 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration[a]	Regional Background Concentration[b]	Number Detection/ Number Samples	Range of Concentrations	Average Concentrations[d]
Round II (continued)					
Nickel (mg/kg)	27.7	37.5	2/2	13.4-19.6	16.5
Silver (mg/kg)	ND	NA	2/2	1.1-2.1	1.6
Zinc (mg/kg)	36.2	33.5	2/2	33.8-44.6	39.2
pH (mg/kg)	NA	NA	2/2	7.8-8.2	8.0
TOC (mg/kg)	NA	NA	2/2	99-400.0	249.5

Notes: NA - not available/not analyzed.
ND - not detected.
E - estimated value

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.
(c) Dragun, 1988.
(b) Average using a zero for non-detects.

10.3.3 Ground Water

In 1988, ground-water samples were collected during Round I of the investigation from two monitoring wells installed at LF05 (MW-201 and MW-202). During the Round II sampling in 1989, ground-water samples were collected from MW-204, MW-201, and MW-202 (a duplicate of MW-202 was obtained). All ground-water samples were analyzed for TCL VOCs, BNAs, PCBs, and Priority Pollutant metals. In addition, ground-water samples collected during Round II sampling were analyzed for total dissolved solids (TDS) and common anions.

Sample-specific analytical results for the investigations are displayed on Figure I-11 (Appendix I) and are summarized in Table 10-3. With the exception of arsenic and nitrate, inorganic concentrations are below Federal primary MCLs. Total dissolved solids, sulfate, and chloride concentrations exceed current Federal secondary MCLs; however, these standards are aesthetic rather than health-based standards. With the exception of the detection of low concentrations of diethylphthalate and butyl benzy phthalate in one downgradient monitoring well, no inorganic contamination was detected in ground-water samples. Table 10-4 summarizes the analytical data at Site LF05.

10.4 POTENTIAL PUBLIC HEALTH RISKS

This section discusses the potential public health risks associated with human exposure to compounds detected in environmental media at LF05. The risk assessment methods used to calculate doses, as well as noncarcinogenic and carcinogenic risks, are discussed in Section 4.0.

Surface/Subsurface Soils

Based on the available analytical data, there is minimal evidence of contamination in the surface and subsurface soils at LF05. With the exception of antimony, inorganic concentrations are comparable to base or regional background levels. The above-background concentration of antimony in one subsurface sample is not likely to pose a public health hazard. The concentration detected is not significantly above levels reported for soils of the United States, human exposure to subsurface soils at LF05 is not likely, and there is no evidence of antimony contamination in site ground water. No significant organic contamination was detected in soil samples collected at LF05.

TABLE 10-3

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF05 - GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentrations	Average Concentrations	Standard/ Criteria
Round I					
Selenium (ug/L)	4.17	1/5	1.6	0.8	10[b]
Chloride (mg/L)	90.7	2/2	7,332-7,335	7,334	250[b]
Nitrate (mg/L)	65.9	1/2	58.6	29.3	10[b]
Sulfate (mg/L)	62.4	2/2	1,197-2,885	2,041	250[c]
Bromide (mg/L)	0.5	2/2	2.5-15.0	8.75	NA
TDS (mg/L)	796	2/2	11,788-18,542	15,165	500[c]
Round II					
Diethyl phthalate (µg/L)	ND	3/4	2E	1.5	NA
Butyl benzyl phthalate (µg/L)	ND	1/4	12	3	NA
Arsenic (µg/L)	ND	4/4	4.2-109	49.7	50[b]
Chromium (µg/L)	ND	1/4	45	11.3	50[b]
Selenium (µg/L)	4.17	1/4	2.5	0.6	10[b]

Note: E - estimated value.
NA - not available.
ND - not detected.

(a) Concentration detected in MW-BB-01.
(b) NIPDWS - National Interim Primary Drinking Water Standard.
(c) Secondary drinking water standard.

TABLE 10-4

SURFACE, SUBSURFACE SOIL, AND GROUND-WATER ANALYTICAL DATA
LANDFILL 2 - LF05
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth (feet)	Arsenic (mg/kg)	Antimony (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
SUBSURFACE SOIL										
SH02-SU-MW201-A	11/08/88	24	--	--	14	--	12.6E	--	16	55
SH02-SU-MW201-X	11/08/88	24	--	--	17	--	6.2E	--	17	65
SH02-SU-MW202-A	11/08/88	25	--	--	26	--	5.6E	--	24	--
SH02-SU-MW203-A	11/10/88	15	2.57	--	26	--	2.58	--	24	--
SH02-SU-MW204-A	07/13/89	5	4.4E	--	6.7	6.7	39.4E	--	13.4	44 6
SH02-SU-MW204-B	07/13/89	13	--	11.1E	11.4	5.5	7.5E	--	19.6	33 8
SURFACE SOIL										
SH02-SS-001-1	12/07/88	0-0.5	3.5E	--	15.1E	38.2E	21.9	0.3	12.2	35 5
SH02-SS-002-1	12/08/88	0-0.5	--	--	7.5E	15.4E	17.5	0.3	--	22 1
SH02-SS-003-1	12/08/88	0-0.5	2.9E	--	63.5E	17.1E	0.92	0.3	--	26.3

Sample Number	Date Sampled	Arsenic (µg/l)	Bromine (mg/l)	Chloride (mg/l)	Chromium (µg/l)	Nitrate (mg/l)	Selenium (µg/l)	Sulfate (mg/l)	Total Dissolved Solids (mg/l)	Diethyl Phthalate (µg/l)	Butyl Benzyl Phthalate (µg/l)
GROUND WATER											
SH03-GW-MW201-A	12/20/88	--	15.0	7,332	--	58.6	--	1,197	11,788	--	--
SH03-GW-MW202-A	12/20/88	--	2.5	7,335	--	--	--	2,885	18,542	--	--
SH02-GW-MW202-B	07/18/89	74.1	NA	NA	--	NA	--	NA	NA	2E	--
SH02-GW-MW202-BD	07/18/89	109E	NA	NA	--	NA	--	NA	NA	2E	12
SH02-GW-MW204-A	07/18/89	4.2E	NA	NA	45.0	NA	--	NA	NA	8E	--
SH02-GW-MW201-B	07/18/89	11.5	NA	NA	--	NA	2.5E	NA	NA	--	--

Notes: E estimated value.
( ) - analytical results below Contract Required Detection Limits (CRDLs)
NA - Not analyzed for this parameter.

Bis(2-ethylhexyl)phthalate concentrations are similar to levels detected in the base background samples. The occurrence of DDE (one positive detection) may be the result of the local application of pesticides. Human exposure to the low pesticide concentration would not result in significant noncarcinogenic or carcinogenic health risks, even under a residential setting, as shown by calculations for similar sites.

Ground Water

Two chemicals (arsenic and nitrate) were detected in the ground water underlying Site LF05 at concentrations exceeding current Federal primary MCLs. However, the nitrate concentration in the background sample for Sheppard AFB also exceeds current standards. The concentrations of chloride, sulfate, and total dissolved solids in downgradient wells MW-201 and MW 202 exceed Federal secondary (aesthetic-based) MCLs. Exposure to nitrate (metabolically converted to nitrite) can cause methemoglobinemia (blue-baby disease) in infants. Arsenic has been classified as a Class A (human) carcinogen. Additionally, ingestional exposure to high concentrations of arsenic can cause hyperpigmentation, hyperkeratosis, and other adverse noncarcinogenic health effects. The following table summarizes risk assessment results based on the assumption that an adult receptor is routinely exposed to arsenic in the ground water underlying LF05 (i.e., the ground water is used as a domestic water supply source):

Arsenic Concentration	Hazard Quotient	Excess Lifetime Cancer Risk
Maximum 109 μg/L	3.1	5.6×10^{-3}
Average 49.7 μg/L	1.4	2.5×10^{-3}

Estimated lifetime cancer risks exceeded 1×10^{-3} when both maximum and average arsenic concentrations are used. An incremental cancer risk of 1×10^{-3} corresponds to a 1-in-1,000 chance that a receptor would develop cancer over a lifetime of exposure. The Hazard Quotient calculated using the maximum and average concentrations exceeds unity, which indicates that adverse noncarcinogenic risks are possible under the exposure conditions used for the risk assessment.

However, as stated previously, the shallow ground water underlying Site LF05 is not currently used as a domestic water supply source. The risk discussion presented for arsenic and the nitrates is relevant for a theoretical human receptor who may use the ground water as a domestic water supply source sometime in the future. Based on the available information, future use of the ground water is considered unlikely because the shallow aquifer at Sheppard AFB has a low yield. Furthermore, the nitrate concentration exceeds the secondary drinking water standard in the background location.

10.5 RECOMMENDATIONS

The remedial investigation conducted at Site LF05 indicates that landfill activities at the site have not resulted in significant soil or ground-water contamination. Minimal organic contamination was detected at the site. Inorganic contamination detected in site ground water should be evaluated in light of the following:

- The analytical results do not indicate widespread arsenic contamination at the site. Arsenic concentrations in excess of the current Federal MCL were detected in only one sample (and a duplicate sample) collected from one monitoring well.

- Arsenic concentrations in soil samples collected at the site did not exceed background concentrations. This suggests that site soils are not a source of the arsenic contamination.

- The concentrations of nitrate in background ground-water samples collected at Sheppard AFB are greater than those detected in LF05.

- Currently, there are no on-site or off-site receptors exposed to contaminants in the ground water. It is not expected that the shallow ground water will be used as a potable water source in the future.

The available date indicate that LF05 is not a significant source of contamination. Based on available data indicating LF05 is not a significant source of contamination, it is recommended that Site LF05 be removed from further IRP consideration.

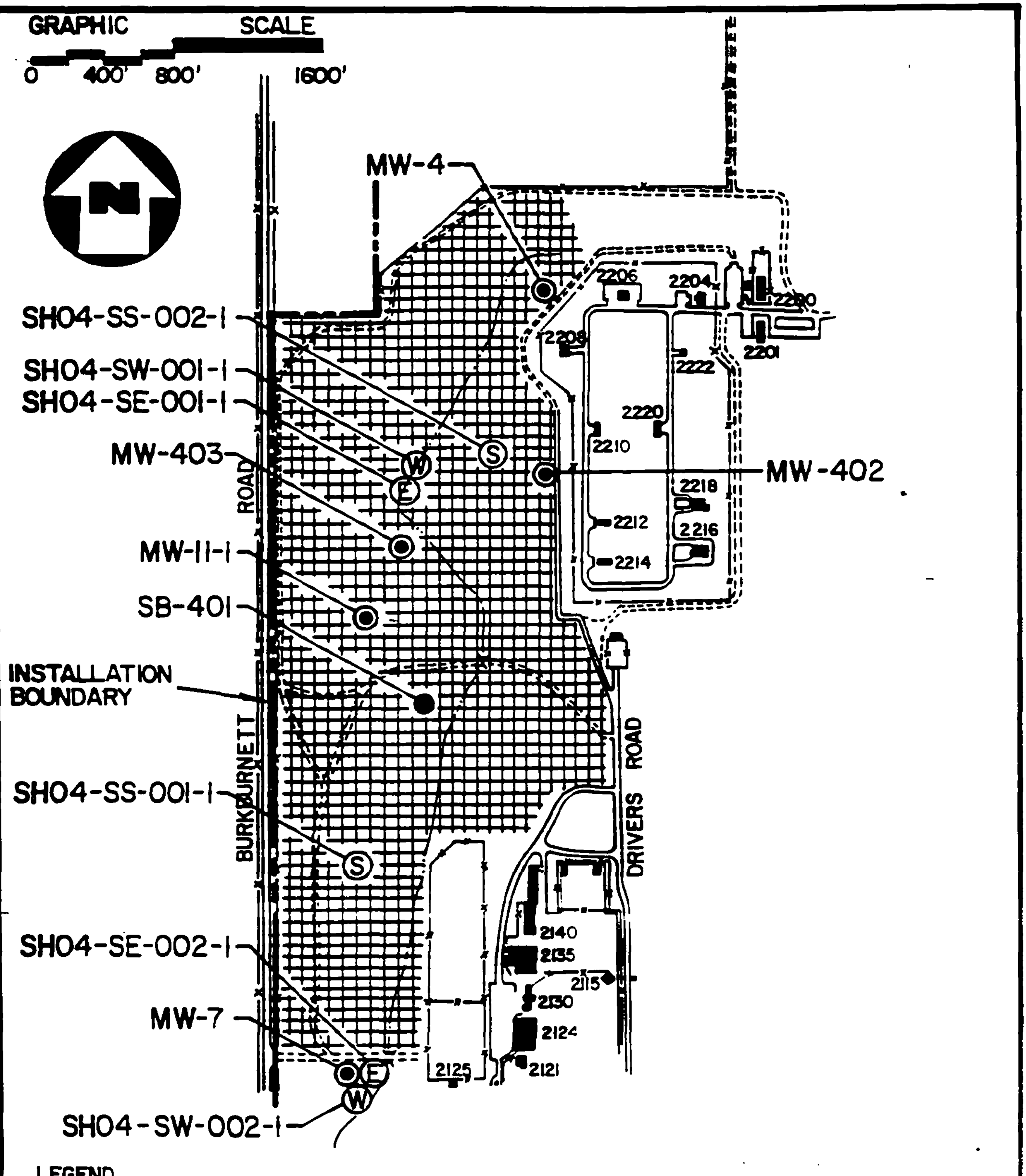
11.0 SITE LF06-LANDFILL 3

11.1 SITE BACKGROUND AND HISTORY

Site LF06 encompasses approximately 60 acres at the northwest corner of the base, and was operated from about 1957 until 1972. The landfill area is located east of State Highway 240 and in an area bounded approximately by Missile Road, the Motor Pool area, the Munitions Storage area, and the City of Wichita Falls water treatment facility (Figures 11-1 and I-12 [Appendix I]). RW08, a possible low level radioactive disposal area, is located near the center of LF06. A portion of LF06 is a disposal area for hardfill and other construction rubble. The hardfill area is located adjacent to the landfill, approximately 800 feet southwest of the Munitions Storage Area. Interviews with base personnel and examination of aerial photographs indicated that the hardfill disposal area was used in the mid-1960s and continues in limited use at the present time. Construction rubble originating from tornado damage to the Sheppard AFB Hospital in 1964 was added to the landfill, and it was subsequently used as a hardfill area. Based on available information, no waste fuels, solvents, or oils were disposed in this area.

The material disposed in the Site LF06 landfill was primarily normal base refuse and some waste treatment sludge. Landfilling was performed as a trench-and-fill operation using trenches approximately 14 feet deep that were oriented east-west. Burning of the refuse occurred until 1968, after which no further burning was conducted. LF06 was first opened near Missile Road and was progressively extended to the north/northeast. By the early 1970s, the area of use extended to the west of the Munitions Storage Area. From approximately 1964 to 1970, trenches at the northern end of the landfill near the Munitions Storage Area received waste oils and refuse. The estimated volume of waste oil disposed ranges from one 55-gallon drum per week to one 55-gallon drum per day (Engineering-Science, 1984).

A subsurface investigation was conducted at LF06 in conjunction with the Phase II investigation (Radian, 1987). Ground water was encountered at two locations at the north and south ends of the landfill near the unnamed creek. Mercury was found to



LEGEND

- MONITORING WELL
- SOIL BORING
- SURFACE SOIL SAMPLE
- SURFACE SEDIMENT SAMPLE
- SURFACE WATER SAMPLE

FIGURE 11-1
SITE PLAN
LANDFILL NO.3 (LF06)
SHEPPARD AIR FORCE BASE

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exceed Federal and State of Texas primary drinking water standards in ground-water samples collected from these wells during the first of two rounds of sampling conducted by Radian. Two additional borings were drilled within the boundaries of the landfill to depths of 40 and 51 feet but did not encounter ground water. The Phase II report concluded that the possibility of off-base migration of contaminants could not be discounted.

11.2 GEOPHYSICAL SURVEY

Electromagnetics (EM), resistivity, and magnetometry surveys were conducted at LF06 during the Phase II Investigation by Radian in 1987. The EM survey was used to define the limits of the site and to detect potential contaminant plumes. The resistivity and magnetometry surveys were used to screen potential sites for monitoring well installation. The results of the EM survey were inconclusive in defining the site limits and no anomalous zones were detected. The resistivity and magnetometry data were successfully used to define drilling locations for monitoring wells that were free of any large buried objects that may have inhibited drilling.

11.3 HYDROGEOLOGIC INVESTIGATION

Because the Phase II Report concluded that off-base migration of contaminants could not be discounted, NUS performed an additional hydrogeologic investigation. Three borings were drilled in the first phase of field work. One boring was placed where it may intercept any potential contamination that was leaving the site near the munitions storage facility. Another boring was placed generally west of the unnamed creek between observed landfill trenches in the center of the site and the creek. A third boring was placed in a presumed downgradient position of landfill trenches south of RW08. Ground water was encountered in two of the borings, and they were completed as monitoring wells. Boring SB401, which remained dry after drilling, was abandoned. Additional subsurface information was obtained from a boring completed as a monitoring well at RW08, which is located near the center of the site.

Borings at LF06 penetrated mostly clayey silt, clay, and weathered shale or siltstone bedrock, with a few thin beds of very fine-grained, silty sandstone. This material was derived from natural weathering of the underlying bedrock. The borings ranged in depth from 41 feet (MW-402) to 60 feet (MW-403). The total depths of the borings were determined in the field based on observation of the core samples for possible water-producing zones. Figure I-12 (Appendix I) shows the location of profile D-D on Figure I-13 at LF06.

Although the core samples generally appeared dry while drilling, ground water entered the borings for MW-402 and MW-403 upon completion. Once monitoring wells were installed in the borings, water levels rose substantially. Currently, water levels range from about 5 to 8 feet below the ground surface in the wells. Ground water apparently flows as seeps through fractures and relict bedding features in the soil and weathered bedrock. Since there is no well-defined aquifer unit, it is difficult to determine whether the water is under confining pressure. However, since fractures and relict bedding features observed in the bedrock cores were all deeper than the present water levels, the water encountered in this system is apparently confined. Water-level measurements were used to construct a potentiometric surface map for the site (Figure I-2 [Appendix I]). The ground water generally flows north, following the surface topography and surface-water flow.

Slug tests performed at MW-402 and MW-403 yielded hydraulic conductivities of 4.0 x 10^{-5} cm/sec and 1.1 x 10^{-5} cm/sec, respectively. The rather low values reflect the slow movement of ground water within the clay, silt, and weathered bedrock.

11.4 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

11.4.1 Surface Soil

Surface soil samples were collected from two locations (SS-001 and SS-002) during Round I of the investigation. These samples were analyzed for TCL VOCs, BNAs, and PCBs, as well as Priority Pollutant metals. Sample-specific analytical results are displayed on Figure I-15 (Appendix I) and are summarized in Table 11-1. Di-n-octylphthalate was the only organic contaminant detected in the Round I surface soil samples. Phthalate compounds are frequently detected in the environment as a result of the widespread use of plastics in our society. Additionally, phthalate compounds are considered common laboratory contaminants. The low-level detection of phthalate compounds in environmental samples is frequently attributable to contamination originating from the powder found inside protective laboratory gloves worn while collecting/handling samples. The low concentrations

R34892

TABLE 11-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF06 - SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Regional Background Concentration[b]	Number Detections/ Number Samples	Range of Concentrations	Average Concentration[c]
Round I					
Di-n-octylphthalate (µg/kg)	ND	NA	1/2	60	30
Arsenic (mg/kg)	2.0	6.5	2/2	2.4-3.9	3.15
Beryllium (mg/kg)	ND	1.5	2/2	1.2-1.7	1.45
Chromium (mg/kg)	10.9	80.0	2/2	12.7-17.9	15.3
Copper (mg/kg)	32.1	15.0	2/2	5.5-5.9	5.7
Lead (mg/kg)	6.0	31.5	2/2	13.8E-16.6E	15.2
Mercury (mg/kg)	0.4	0.04	2/2	0.2-0.4	0.3
Nickel (mg/kg)	27.7	37.5	2/2	12.6-19.5	16.05
Zinc (mg/kg)	36.2	33.5	2/2	25.4E-29.8E	27.6

Notes: NA - not available.
ND - not detected.
E - estimated value.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.
(c) Averages calculated using zero for nondetctions.

of di-n-octylphthalate at Site LF06 is not considered indicative of widespread organic contamination resulting from landfilling activities. The Round I analytical results for metals are similar to base and/or published background soil concentrations.

11.4.2 Subsurface Soil

A total of nine subsurface soil samples were collected at various depths during the drilling of two monitoring wells (MW-402 and MW-403) and one soil boring (SB-401). Samples were analyzed for TCL VOCs, BNAs, and PCBs as well as Priority Pollutant metals. Selected samples were analyzed for CEC. Sample locations are shown on Figure I-14 (Appendix I). Sample-specific results are displayed on Figure I-15 (Appendix I) and are summarized in Table 11-2. No organic contaminants were detected in the subsurface soils. Generally, the metals concentrations reported for the Round I samples are similar to base and/or published background soils concentrations. Silver (C = 10.9 mg/kg) was detected in one subsurface soil sample at a concentration that exceeds base and regional background levels. However, silver was not detected in any other samples of environmental media at LF06.

11.4.3 Surface Water/Sediment

Two surface water/sediment samples were collected from the unnamed creek which flows through the landfill. These samples were analyzed for TCL VOCs, BNAs, and PCBs, as well as Priority Pollutant metals. Additionally, surface water samples were analyzed for cyanide, total phosphate and common anions. Sample-specific analytical results are presented on Figure I-16 (Appendix I) and are summarized in Tables 11-3 and 11-4.

The analytical results indicate that landfilling activities at LF06 have not had a substantial impact on surface waters or sediments in proximity to the site. Butyl benzyl phthalate (6 µg/L) was the only organic compound detected in the surface water samples. Organic compounds were not detected in the sediments. Phthalate compounds are considered common laboratory contaminants and are also frequently detected in environmental samples as a result of the widespread use of plastics. The low concentration of butyl benzyl phthalate detected is not considered evidence of serious contamination at LF06. With the exception of one total dissolved solids detection, the concentrations of metals and common anions detected in the

TABLE 11-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF06 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Regional Background Concentration[b]	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round I					
Arsenic (mg/kg)	2.0	6.5	8/9	0.8-5.8	2.7
Beryllium (mg/kg)	ND	1.5	9/9	1.1-2.2	1.49
Cadmium (mg/kg)	ND	0.01-7.0[c]	2/9	1.0-1.1	0.2
Chromium (mg/kg)	10.9	80.0	9/9	30.0-47.6	36.8
Copper (mg/kg)	32.1	15.0	4/9	7.2-12.0	4.2
Lead (mg/kg)	6.0	31.5	9/9	1.52-14.8	7.72
Mercury (mg/kg)	0.4	0.04	2/9	0.2	0.04
Nickel (mg/kg)	27.7	37.5	9/9	27.0-42.3	33.2
Silver (mg/kg)	ND	0.1-5.0[c]	1/9	10.9	1.2
Zinc (mg/kg)	36.2	33.5	7/9	40.6-83.0	42.8
CEC	NR	NR	3/3	27.6-38.6	31.7

Notes: NR - not reported.
ND - not detected.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.
(c) Native soil concentrations of cadmium may range between 0.01 and 7.0 mg/kg. A reported upper limit was 45 mg/kg. Native soil concentrations of silver range from 0.1 to 5.0 mg/kg. A reported upper limit was 50 mg/kg (Dragun, 1988).

TABLE 11-3

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF06 - SURFACE WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Number Detections/ Number Samples	Range of Concentrations	Average Concentration	Standard/ Criteria
Round I				
Butyl benzyl phthalate (µg/L)	1/2	6.0	3	NA
Antimony (µg/L)	1/2	55.5	27.8	3[a]
Bromide (mg/L)	2/2	0.91-2.90	1.91	NA
Chloride (mg/L)	2/2	78.1-160.0	119.1	250[b]
Fluoride (mg/L)	2/2	1.1-1.4	1.25	4[d]
Nitrate (as N) (mg/L)	1/2	0.81	0.41	10[c]
Phosphate (Tot.) (mg/L)	2/2	34.8-57.6	46.2	NA
Sulfate (mg/L)	2/2	49.2-72.8	61.0	250[b]
TDS (mg/L)	2/2	437-632	534.5	500[b]

(a) Maximum Contaminant Level Goal - All MCLGs are from Drinking Water Regulations and Health Advisories - USEPA (4/89) unless otherwise noted.
(b) Federal SDWA Secondary Maximum Contaminant Level advisory.
(c) NIPDWR - National Interim Primary Drinking Water Regulation advisory.
(d) Federal SDWA Primary Maximum Contaminant Level.

R34892

TABLE 11-4

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF06 - SEDIMENT
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[(a)]	Regional Background Concentration[(b)]	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
Round I					
Arsenic	2.0	6.5	2/2	6.4-6.7	6.55
Beryllium	ND	1.5	2/2	2.1-2.2	2.15
Chromium	10.9	80.0	2/2	25.5-27.5	26.5
Copper	32.1	15.0	2/2	19.3-21.4	20.4
Lead	6.0	31.5	1/2	29.9	15.0
Mercury	0.4	0.04	2/2	0.50	0.50
Nickel	27.7	37.5	2/2	32.5-34.1	33.3
Zinc	36.2	33.5	2/2	59.2-62.1	60.7

Notes: NA - not available.
ND - not detected.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.

surface water samples are below all currently available Federal MCLs. The estimated antimony concentration (55.5 µg/L) detected in one surface water sample exceeds a tentative MCLG (3 µg/L) currently under consideration by the Federal EPA; but it is less than the currently available AWQC (146 µg/L) for the protection of human health. The butyl benzyl phthalate (6 µg/L) and antimony (55.5 µg/L [estimated]) concentrations previously discussed were reported for the surface water sample collected from the unnamed creek as it enters LF06. Consequently, upstream sources may be contributing to the contaminant levels found. Phosphate was detected in the surface waters at the upstream and downstream locations at 57.6 mg/L and 34.8 mg/L, respectively. Metals concentrations reported for the Round I sediment samples are similar to base and/or published background soil concentrations.

11.4.4 Ground Water

During Round I of the site investigation, ground-water samples were collected from four monitoring wells within and bordering LF06. Samples collected from two NUS monitoring wells (MW-402 and MW-403) and two existing monitoring wells (MW-4 and MW-7) were analyzed for TCL VOCs, BNAs, and PCBs as well as Priority Pollutant metals, cyanide, TDS, and common anions. Monitoring wells MW-402 and MW-7 were reanalyzed for selected contaminants during Round II of the investigation. Sample-specific analytical results are displayed on Figure I-16 (Appendix I) and are summarized in Table 11-5. All analytical data for LF06 is presented in Tables 11-6 and 11-7.

The analytical results indicate that there is limited evidence of landfill activities in the ground water underlying LF06. Benzene ($C = 5$ µg/L) was detected in one Round II ground-water sample (MW-402). Selenium ($C_{max} = 17$ µg/L) was detected in two site monitoring wells at concentrations exceeding the current Federal primary MCL. However, the concentration detected does not exceed the proposed primary MCLG (50 µg/L) currently under review by the EPA. None of the other metals or benzene were detected in LF06 wells at concentrations that exceed current Federal MCLs. The fluoride levels detected in MW-402 and MW-403, as well as the chloride, sulfate, and TDS levels of several monitoring wells, exceed the current Federal MCLs.

R34892

TABLE 11-5

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF06 - GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration	Number Detections/ Number Samples	Range of Concentrations	Average Concentration	Standard/ Criteria
Round I					
Arsenic (µg/L)	ND	1/4	7.0	1.8	50[a]
Lead (µg/L)	ND	1/4	2.0	0.5	50[a]
Selenium (µg/L)	4.17	3/4	7.0-17	9.4	10[a]
Cyanide (µg/L)	NR	1/4	6.63	1.7	200[b]
Bromide (mg/L)	0.5	4/4	14.1-23.1	17.7	NA
Chloride (mg/L)	90.7	4/4	2,529-3,650	3,120	250[c]
Fluoride (mg/L)	0.82	2/4	5.2-6.9	3.0	4[d]
Nitrate (as N) (mg/L)	65.9	4/4	1.3-9.7	4.85	10[a]
Phosphate (Tot.) (mg/L)	NR	2/4	241-279	130	NA
Sulfate (mg/L)	62.4	4/4	954-1,608	1,306	250[c]
TDS (mg/L)	796	3/4	1,123-14,408	6,449	500[c]

R34892

TABLE 11-5

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE LF06 - GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration	Number Detections/ Number Samples	Range of Concentrations	Average Concentration	Standard/ Criteria
Round II					
Benzene (µg/L)	ND	1/2	5.0	2.5	5(d)
Arsenic (µg/L)	ND	1/2	10.8	5.4	50(a)
Chromium (µg/L)	ND	1/2	7.0	3.5	50(a)
Selenium (µg/L)	4.17	1/2	5.8	2.9	10(a)

Note: ND - not detected.

(a) NIPDWR - National Interim Primary Drinking Water Regulation advisory.
(b) Maximum Contaminant Level Goal - All MCLGs are from Drinking Water Regulations and Health Advisories - USEPA (4/89) unless otherwise noted.
(c) Federal SDWA Secondary Maximum Contaminant Level advisory.
(d) Federal SDWA Primary Maximum Contaminant Level.

R34892

TABLE 11-6

LANDFILL NUMBER 3 (LF06)
SURFACE SOIL, SUBSURFACE SOIL, AND SEDIMENT ANALYTICAL DATA
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth (feet)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)	Di-N-Octylphthalate (ug/kg)
SUBSURFACE SOIL													
SH04-SU-MW401-A	11/12/88	6	2.63	1.1	1 0E	31	--	6 7E	--	30	--	66	--
SH04-SU-MW401-B	11/12/88	13	--	1 9	--	37	--	1 52E	32	--	--	--	--
SH04-SU-MW401-C	11/12/88	23	2 75	1 1	1 0E	31	9 8E	5 72E	36	--	8 3	--	--
SH04-SU-MW402-A	11/12/88	6	4 2	1 5	--	35	--	13 7E	27	--	--	--	--
SH04-SU-MW402-B	11/12/88	11	2 59	1 7	--	46	--	7 0E	31	54	--	--	--
SH04-SU-MW402-C	11/12/88	19	5 8	1 1	--	30	--	14 8E	30	51	--	--	--
SH04-SU-MW403-A	12/12/88	6	1 9	1 4	--	42 9E	12	8 3	--	39E	--	40.6	--
SH04-SU-MW403-B	12/12/88	12	0.8	2 2	47 6E	--	7 2	6 3	0.2	42.3E	10 9	48 8	--
SH04-SU-MW403-C	12/12/88	17	3	1 4	1 1	31 1	9 2	5 4	0 2	31.9E	--	42 1	--
SURFACE SOIL													
SH04-SS-001-1	12-08-88	0-0 5	2 4	1 2	--	12 7	5 5	16 6E	0 4	12.6	--	25 4E	--
SH04-SS-002-1	12.08.88	0 0 5	3.9	1 7	--	17 9	5 9	13 8E	0 2	19.5	--	29 8E	60
SEDIMENT													
SH04-SE-001-1	12 08 88	0-0 5	6 7	2 2	--	25 5	21 4	29 9E	0 5	34 1	--	62 1	--
SH04-SE-002-1	12-08.88	0-0 5	6 4	2 1	--	27 5	19 3	--	0 5	32 5	--	59.2E	--

Notes: E - estimated value

(--) - analytical results below Contract Required Detection Limits (CRDLs)

TABLE 11-7

GROUND-WATER AND SURFACE-WATER ANALYTICAL DATA
LANDFILL NUMBER 3 (LF06)
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Arsenic (µg/1)	Benzene (µg/1)	Bromine (mg/1)	Chloride (mg/l)	Chromium (µg/l)	Cyanide (µg/l)	Fluoride (mg/l)	Lead (µg/l)	Nitrate (mg/l)	Selenium (µg/l)	Sulfate (mg/l)	Total Dissolved Solids (mg/l)	Total Petroleum Hydrocarbons (mg/l)
GROUND WATER														
SH04-GW-MW004-A	11/19/88	--	--	15.8	3,151.0	--	--	--	2E	9.7	7	954.0	--	241.0
SH04-GW-MW007-A	11/19/88	7	--	14.1	3,149.0	--	--	--	--	1.3	17.0	1,594.0	1,123	279 8
SH04-GW-MW402-A	12/18/88	--	--	17 7	3,650	--	--	5.2	--	4.7	13.5	1,069	10,268	--
SH04-GW-MW403-A	12/18/88	--	--	23.1	2,529	--	6.63E	6.9	--	3.7	--	1,608	14,408	--
SH04-GW-MW007-B	07/12/89	--	--	NA	NA	--	--	NA	--	NA	--	NA	NA	NA
SH04-GW-MW402-B	07/12/89	10.8	5	NA	NA	7	--	NA	--	NA	5.8E	NA	NA	NA

Sample Number	Date Sampled	Antimony (µg/l)	Bromine (mg/kg)	Butylbenzyl-phthalate (µg/l)	Chloride (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Sulfate (mg/l)	Total Dissolved Solids (mg/l)	Total Petroleum Hydrocarbons (mg/l)
SURFACE WATER										
SH04-SW001-1	12/08/88	--	2.9	--	78.1	1.1	--	49.2	437	34.8
SH04-SW002-1	12/08/88	55.5E	0.91	6	160.0	1.4	0.81	72 8	632	57.6

Note: (--) - analytical results below Contract Required Detection Limits (CRDLs).
E - estimated.
NA - not analyzed for this parameter.

11.5 POTENTIAL PUBLIC HEALTH RISKS

This section discusses the potential public health risks associated with human exposure to indicator chemicals detected in the environmental media at LF06. Risk assessment methods and indicator chemical selection were discussed in Section 4.0.

Surface/Subsurface Soils

Because significant contamination was not detected in the surface or subsurface soils at LF06, a quantitative risk analysis of the levels of inorganic or organic compounds detected was not necessary. With the exception of silver, inorganic levels are comparable to base or regional background levels. The isolated detection of silver in one subsurface soil sample is not evidence of site-wide contamination. Additionally, there is no evidence of elevated silver concentrations in the other environmental media at the site. Furthermore, no significant organic contamination was detected at LF06. The detection of di-n-octyl phthalate in one surface soil sample was similar to phthalate concentrations detected in base background samples.

Surface Waters/Sediments

The site investigation results presented in Section 11.4 indicate that there is minimal evidence of contamination in the surface waters/sediments of the unnamed creek that passes through LF06. The most significant contamination was noted in the surface water sample collected from the creek as it enters the landfill. The antimony concentration detected in that surface water sample exceeds concentrations that would be acceptable in a public drinking water supply. The Hazard Quotient (HQ) calculated assuming that an individual routinely uses a water supply contaminated with 55 µg/L antimony exceeds unity (HQ = 3.9), which indicates that adverse noncarcinogenic health effects are possible. However, the unnamed creek in the vicinity of LF06 is not currently used as a water supply source; recreational facilities are not currently located along the creek; and, based on the current use of the site, base personnel do not frequently contact the creek surface waters or sediments as a result of routine, planned activities at the base. Finally, the creek is too shallow for swimming; therefore, accidental ingestion of surface waters is not a plausible exposure scenario. The antimony concentrations detected are not considered great enough to create a public health risk for the occasional visitor to the site who may come in contact with creek surface waters. The fact that antimony was not detected at the downstream location, or in any other environmental media sampled at the site, indicates that upstream sources may be contributing to the concentrations detected.

Ground Water

Common anions such as fluoride, as well as selenium, and benzene were detected in the ground water underlying LF06. The maximum fluoride concentrations (C_{max} = 6.9 mg/L) exceed current Federal primary MCLs. The maximum selenium concentration (17 µg/L) exceeds the current but not the proposed MCL, and the average selenium concentration (9.4 µg/L) to less than the current Federal primary MCL. Chronic ingestional exposure to fluoride levels exceeding the current Federal MCLs can result in the development of fluorosis (sclerosis, hardening, and induration) of bone and mottled teeth. The following table summarizes risk assessment results, assuming that an adult individual routinely uses a water supply containing 5 µg/L benzene and 6 mg/L fluoride:

Contaminant	Federal MCL	Reference Dose	Hazard Quotient	Cancer Slope Factor	Incremental Cancer Risk
Benzene - 5 µg/L	5 µg/L	NA	-	2.9×10^{-2}	4×10^{-6}
Fluoride - 6 mg/L	4 mg/L	6×10^{-2} mg/kg-day	2.9	NA	-

The estimated incremental cancer risk for benzene through ingestion is within the 10^{-4} to 10^{-7} cancer risk range frequently considered in the development of regulatory standards/criteria or in the development of site cleanup goals. It is important to note that benzene was detected in only one of the four site monitoring well samples at a concentration equivalent to the current Federal MCL (5 µg/L). The HQ exceeds unity when the 6 mg/L fluoride concentration is used indicating that adverse health effects (e.g., dental fluorosis) are possible. These risks are estimated for a human receptor who may, in the future, use the shallow ground-water at the site as a domestic water supply source. Currently, the shallow ground-water at Sheppard AFB is not used as a domestic water supply source, and future use of the ground water is considered unlikely because of low yield.

11.6 RECOMMENDATIONS

The remedial investigation conducted at Site LF06 indicates that past landfilling activities have not resulted in significant soil, surface water, sediment, or ground-water contamination. Few organic contaminants were found above analytical detection limits in the environmental samples analyzed. The inorganic contamination found must be evaluated in light of the following:

- Inorganic chemicals were detected infrequently. There is no evidence of pervasive metals contamination at the site.

- Silver and antimony were detected in one subsurface soil sample and one surface water sample, respectively. These metals were not detected at concentrations above background in other environmental media sampled. Antimony was detected in a surface water sample collected from the unnamed creek as it enters the landfill area. Consequently, upstream sources may be contributing to the detected contamination.

- Fluoride levels slightly above the current Federal drinking water standard were detected in two site monitoring wells. However, fluoride was not detected in the downgradient monitoring well situated to monitor ground-water quality as it exits the landfill.

- The shallow ground-water resource at Sheppard AFB is not currently used as a domestic water supply source, and future use is considered unlikely.

The available data indicate that LF06 is not a significant source of contamination. Based on available data indicating LF06 is not a significant source of contamination, it is recommended that Site LF06 be removed from further IRP consideration.

12.0 SITE RW07 - LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE

12.1 SITE BACKGROUND AND HISTORY

Low-level radioactive wastes were reported to have been disposed in a dry well located next to the sewage treatment facility. The disposal well was reported to be concrete-lined, about 6 inches in diameter, 14 feet deep, and surrounded by a locked fence (see Figure 12-1 and Figure I-3). The well was reportedly installed in the early 1950s for the disposal of X-ray waste from the Sheppard AFB Hospital. It is alleged that the well was used on one occasion during the mid to late 1950s, but the volume, identity, and source of material are unknown. No written records are available to indicate whether the site was actually ever used; however, the site is presently surrounded by a chain-link fence and marked as a radioactive area.

12.2 SUBSURFACE INVESTIGATION

NUS hand excavated the entire site with a shovel in an effort to locate the top of the concrete casing. The entire fenced area was completely excavated to a depth of about 2.7 feet, and no well was discovered. An NUS hydrogeologist determined that the excavated material was natural soil, which consisted of weathered sandstone. It was concluded that the area had not been disturbed as would be expected if a large-diameter well had been installed, and that the disposal well was not located in the fenced area. The entire excavation procedure was closely monitored with a radiation detection device (Geiger-Müller counter), and no readings above normal background were recorded.

12.3 RECOMMENDATIONS

The RI conducted at this site uncovered no evidence that the disposal well was ever installed and no evidence that disposal of low level radioactive waste ever occurred at Site RW07. The investigation confirmed that only background levels of radiation exist at this site. It is therefore recommended that Site RW07 be removed from further consideration under the IRP.

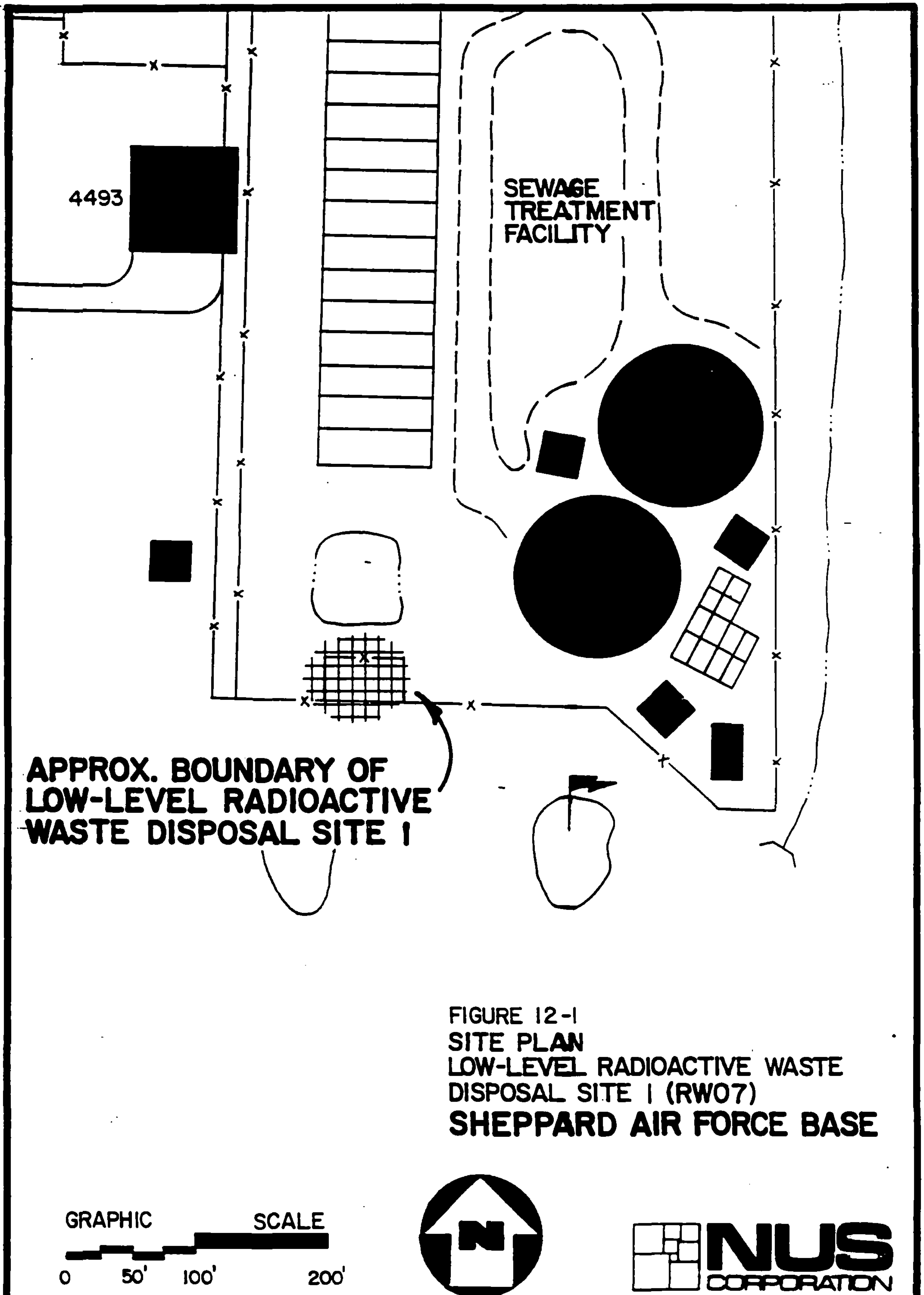


FIGURE 12-1
SITE PLAN
LOW-LEVEL RADIOACTIVE WASTE
DISPOSAL SITE I (RW07)
SHEPPARD AIR FORCE BASE

13

13.0 SITE RW08 - LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE IN LANDFILL 3

13.1 SITE BACKGROUND AND HISTORY

The radioactive waste burial vault in LF06 is located in a marked area approximately 100 feet square (Figure 13-1 and Appendix I-12). It is alleged that the site was activated and marked in the late 1950s or early 1960s, and that a radioactive tool or wrench used in munitions maintenance may have been deposited in the vault on one occasion. However, no written records are available to indicate whether the site was actually ever used.

13.2 GEOPHYSICAL INVESTIGATION

NUS attempted a magnetometer and electromagnetic (EM) survey at the site to locate the radioactive waste burial vault. The magnetometer instrument used was an Omni-IV manufactured by EDA Instruments. The EM survey utilized an EM-31 instrument manufactured by Geonics Limited. However, the abundance of metal and demolition debris at the site rendered the instruments ineffective, and the investigation was halted.

13.3 HYDROGEOLOGIC INVESTIGATION

A single boring was drilled downgradient of the marked disposal area and was used for the installation of monitoring well MW11-1. The boring was drilled to a depth of 60 feet and penetrated clay, silt, and weathered siltstone of the Petrolia Formation. Ground water was inferred to occur at a depth of 28.5 feet, in weathered siltstone, where the relict bedding features of the core appeared moist. The remaining core samples appeared dry.

The water level in the well was measured at about 8 feet below the ground surface, once the water level had stabilized. This suggests the water in the seep(s) is locally confined. A slug test conducted in the well indicated that the hydraulic conductivity

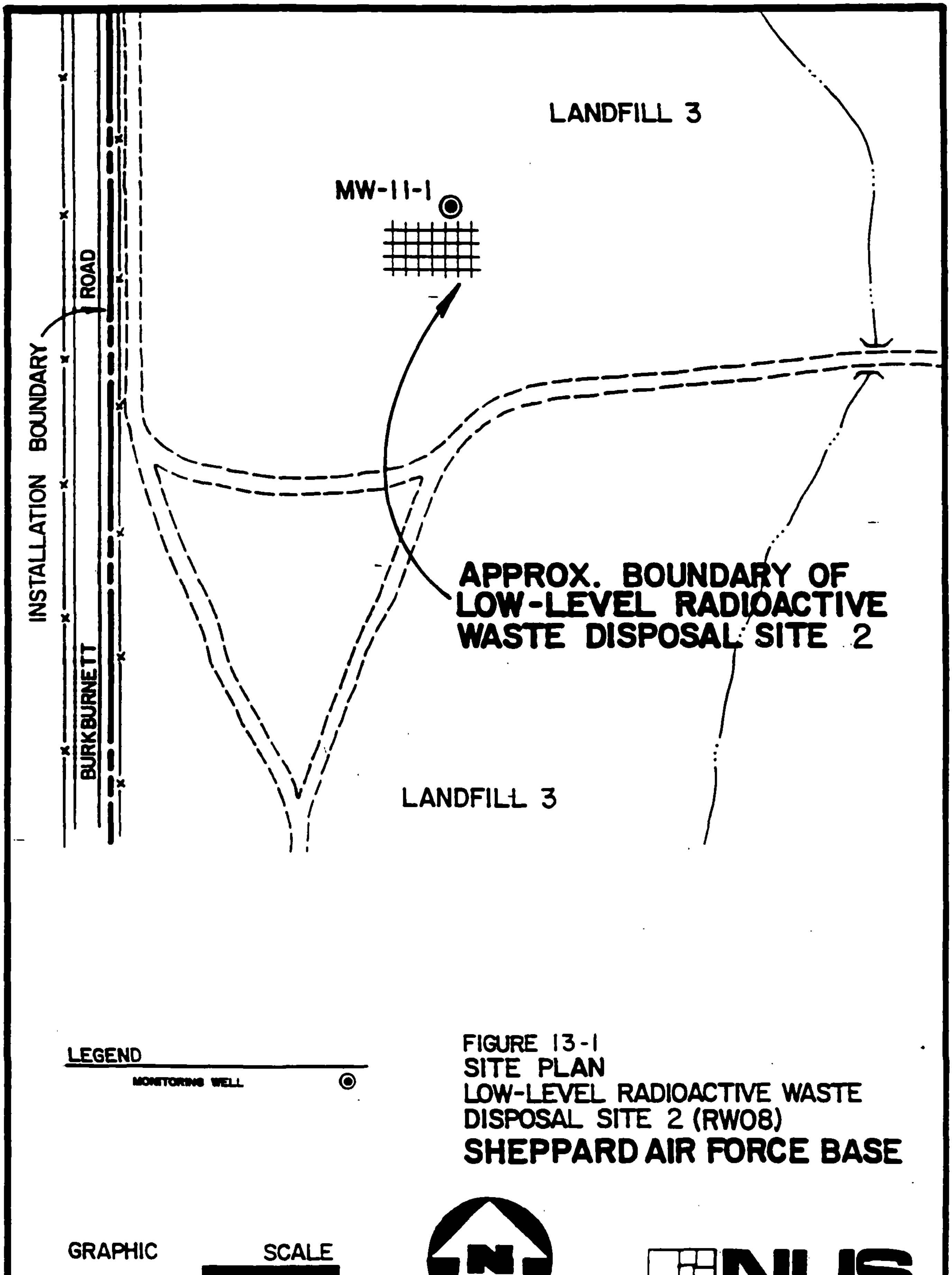


FIGURE 13-1
SITE PLAN
LOW-LEVEL RADIOACTIVE WASTE
DISPOSAL SITE 2 (RW08)
SHEPPARD AIR FORCE BASE

is 2.0 x 10^{-5} cm/sec. Based on water-level data from surrounding wells in LF06, ground water moves generally north, toward a tributary to Bear Creek (Figure 13-2).

13.4 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

13.4.1 Subsurface Soils

One subsurface soil sample was obtained from the soil boring SB11-1. Since the disposal site was located in an old landfill, the soil sample was analyzed for TCL VOCs, BNAs, PCBs, and Priority Pollutant metals. Additionally, this sample was analyzed for radiological contaminants (gross alpha, gross beta, and gamma activity).

Table 13-1 presents the results of the metals and radiological analyses and compares the results to base and regional background levels. Sample-specific analytical results are depicted in Figure I-15 (Appendix I). No organic compounds were detected in the soil sample analyzed. Reported concentrations for most inorganics detected are below base and/or published background levels of metals in soils. Although the zinc level exceeds both the base and published background values, the concentration detected is less than twice the background levels, which is not considered a significant difference. The activities of thorium-232, radium-228, and radium-226 ranged from 1.1 to 2.0 pCi/g. The levels detected are less than two times the background concentrations. The CEC of the soil sample was 9.44 meq/100 grams of soil. A CEC of this magnitude is typical of sandy or loam soils and indicates that metals might easily migrate through the soil if other soil parameters, such as pH, are favorable. Because metals and radiological levels reported for the Round I investigation were similar to background levels, a second sampling phase was not conducted at Site RW08.

13.4.2 Ground Water

A ground-water sample obtained from monitoring well MW11-1 was analyzed for the following parameters:

- TCL VOCs, BNAs, and PCBs
- Priority Pollutant metals
- Gross alpha and gross beta activity

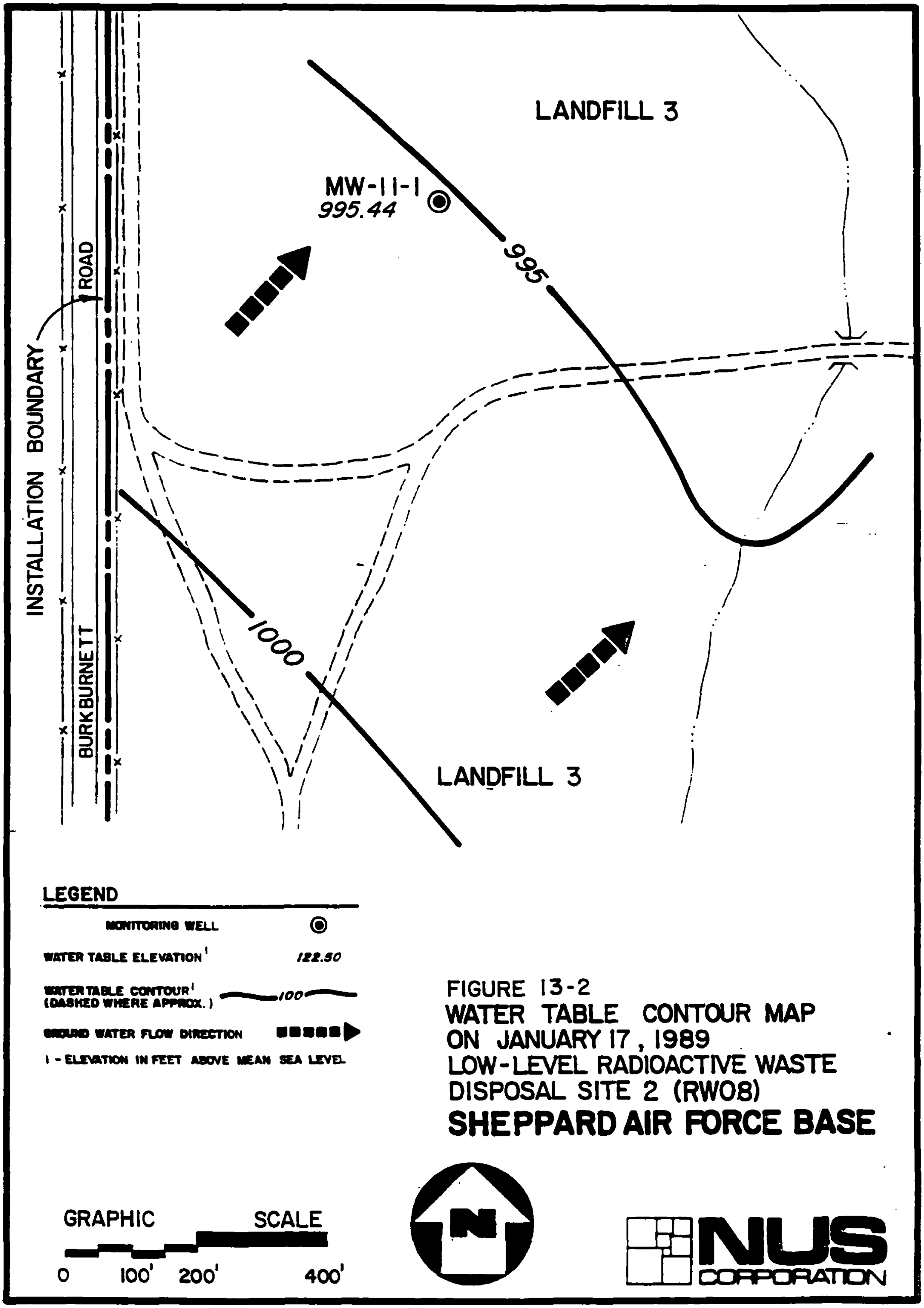


FIGURE 13-2
WATER TABLE CONTOUR MAP
ON JANUARY 17, 1989
LOW-LEVEL RADIOACTIVE WASTE
DISPOSAL SITE 2 (RW08)
SHEPPARD AIR FORCE BASE

TABLE 13-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE RW08 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentrations[a]	Regional Background Concentrations[b]	Number Detections/ Number Samples	Range of Concentrations
Round I				
Arsenic (mg/kg)	2	6.5	1/1	1.8
Beryllium (mg/kg)	ND	1.5	1/1	1.4
Chromium (mg/kg)	10.9	80	1/1	30.9
Copper (mg/kg)	32.1	15	1/1	18.3
Lead (mg/kg)	6	31.5	1/1	7.0
Mercury (mg/kg)	0.4	0.04	1/1	0.1
Nickel (mg/kg)	27.7	37.5	1/1	36.1
Zinc (mg/kg)	36.2	33.5	1/1	63.3
CEC (meq/100g)	10.6	NA	1/1	9.44
Gamma emitters Th-232 (pCi/g)	0.9	NA	1/1	2.0
Ra-228 (pCi/g)	1.0	NA	1/1	1.8
Ra-226 (pCi/g)	0.8	NA	1/1	1.1

Note: NA - not available.
E - estimated value.
ND - not detected.

(a) Average of two subsurface soil samples collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.

- Gamma activity
- Common anions

No organic contaminants or metals were detected in the ground-water sample; however, several common anions and two radioisotopes were detected. The analytical results are displayed on Appendix I-16 and presented in Table 13-2. The concentrations of chloride (C = 7,370 mg/L), sulfates (C = 2,254 mg/L), and TDS (C = 14,635 mg/L) exceed existing Federal secondary MCLs (aesthetic-based standards) and are elevated above base background levels. The level of fluorides (C = 6.7 mg/L) detected exceeds the current Federal primary MCLs (4 mg/L), which is a health-based standard. These elevated levels of the common anions may be reflective of the fact that the site exists within a landfill setting. The Round I radium-226 and radium-228 results (combined result = 5.8pCi/L) marginally exceeds the current Federal primary MCLs, which state that the combined radium-226 and radium-228 radioactivity shall not exceed 5pCi/L. Gross alpha and gross beta values were not reported due to matrix interference. Round II radiological results (radium-226 = 2.3 pCi/L; radium-228 = 1.8pCi/L) do not exceed Federal standards. Table 13-3 presents all the analytical data for Site RW08.

13.5 POTENTIAL PUBLIC HEALTH RISKS

The analytical results discussed in Section 13.4 are not strongly indicative of radiological contamination migrating from Site RW08. Although the combined Round I radium-226/228 ground-water results marginally exceed the current Federal primary MCL and base background levels, the combined Round II radium-226/228 ground-water results are below the current standard. Soil results also appear to reflect background contaminant levels. Although the concentrations of several common anions in the ground water exceed current Federal standards for four parameters, the results are probably reflective of landfill conditions in which the site is located. The common anion results are not an indication of radiological contamination.

13.6 RECOMMENDATIONS

The remedial investigation results indicate that Site RW08 is not a significant source of radiological contamination of ground water or soils at Sheppard AFB. The radiological results available to date are similar to back ground levels detected at

TABLE 13-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE RW08 - GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentrations	Standards/Criteria
Round I				
Chloride (mg/L)	90.7	1/1	7,370	250[b]
Nitrate (as N) (mg/L)	65.9	1/1	2.7	10[c]
Sulfate (mg/L)	62.4	1/1	2,254	250[b]
Total dissolved solids (mg/L)	796	1/1	14,635	500[b]
Fluoride (mg/L)	0.82	1/1	6.7	4[c]
Bromide (mg/L)	0.5	1/1	21.6	NA
Radium-226 (pCi/L)	ND	1/1	2.4	5[c]
Radium-228 (pCi/L)	1.8	1/1	3.4E	5[c]
Round II				
Radium-226 (pCi/L)[a]	0.9	1/1	2.3E	5[c]
Radium-228 (pCi/L)	2.4	1/1	2.2E	5[c]

Notes: NA - not available.
ND - not detected.
E - estimated value.

(a) One ground-water sample collected at the base, not near any IRP site.
(b) Federal SDWA Secondary MCL.
(c) Federal SDWA Primary MCL.
(d) Average of four samples taken at other sites.

TABLE 13-3

SUBSURFACE SOIL AND GROUND-WATER ANALYTICAL DATA
RW08 - LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA 2
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth (feet)	Arsenic (mg/kg)	Beryllium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Gross Thorium 232 (pCi/g)	Gross Radium 228 (pCi/g)	Gross Radium 226 (pCi/g)
SUBSURFACE SOIL													
SH11-SU-SB11-1-A	12/11/88	10	1.8	1.4	30.9E	18.3	7	0.1	36.1E	63.3	2.0 ± 0.2	1.8 ± 0.2	1.1 ± 0.2

Sample Number	Date Sampled	Bromine (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Radium 226 (pCi/L)	Radium 228 (pCi/L)	Sulfate (mg/L)	TDS (mg/L)
GROUND WATER									
SH11-GW-MW11-1A	12/18/88	21.6	7,370[a]	6.7	2.7	2.4 ± 0.1	3.4 ± 0.6E	2,254[a]	14,635[a]
SH11-GW-MW11-1B[b]	07/12/89	NA	NA	NA	NA	2.3 ± 0.3E	2.2 ± 1.3E	NA	NA
RADIOLOGICAL BACKGROUND									
SH04-GW-MW007-B	07/12/89	NA	NA	NA	NA	--	--	NA	NA
SH03-GW-MW302-B	07/12/89	NA	NA	NA	NA	3.5 ± 0.4E	4.4 ± 1.2E	NA	NA
SH03-GW-MW302-BD	07/12/89	NA	NA	NA	NA	--	3.0 ± 1.4E	NA	NA
SH03-GW-MW301-B	07/12/89	NA	NA	NA	NA	--	2.2 ± 0.93	NA	NA

(a) These values exceed Federal Safe Drinking Water Act, Secondary Maximum Contamination Levels but are not attributable to RW08.

(b) Round II sampling.

Notes: E - estimated value.

NA - not analyzed for this parameter.

(--) - analytical results below Contract Required Detection Limits (CRDLs).

Sheppard AFB and are unlikely to pose an increased threat to the public health or the environment above current background risk levels. Site RW08 should be removed from further consideration under the IRP.

14

14.0 SITE WP10 - INDUSTRIAL WASTE PIT 2

14.1 SITE BACKGROUND AND HISTORY

An earthen industrial waste pit, located north of the wastewater treatment facility, was used during the 1950s as a storage pond for waste oils and fuels from the old engine test cells (Figure 14-1). An industrial waste line ran from the test cells south to the earthen pit. The oils in the pit are known to have been burned on at least two occasions during the 1950s. The pit is no longer used for industrial waste storage, but is currently used as an overflow basin for the effluents from an oil-water separator (Engineering-Science 1984). The effluent enters the former pit area at a concrete-lined pond through a 4-inch pipe, and overflow exits the pond through a storm drain that empties into a neighboring creek.

14.2 HYDROGEOLOGIC INVESTIGATION

Three borings were drilled at the site and completed as monitoring wells. The first boring was drilled in December 1988. Based on suspected soil contamination encountered at the site, two other borings were added in July 1989. The borings were positioned so there was one well upgradient and two wells downgradient of the concrete-lined pond. The borings extended to depths ranging from 25 feet (MW-803) to 34 feet (MW-801).

The borings penetrated soil and weathered bedrock of the Petrolia Formation; however, fill material was encountered at MW-802. The fill was composed of silt, clay, and sand with some crushed stone and traces of an asphalt or tar-like material. The fill was present only at MW-802 and extended to a depth of 8.5 feet. A lens of sand and weathered sandstone was found throughout the site, at depths ranging from the surface at MW-801 to 8.5 feet at MW-802, where the sand was covered by fill. Beneath the sandstone unit is at least 20 feet of clay and weathered, shaley siltstone. Figure I-3 in Appendix I shows the location of the profile shown in Figure 14-2, which illustrates the stratigraphy at the site.

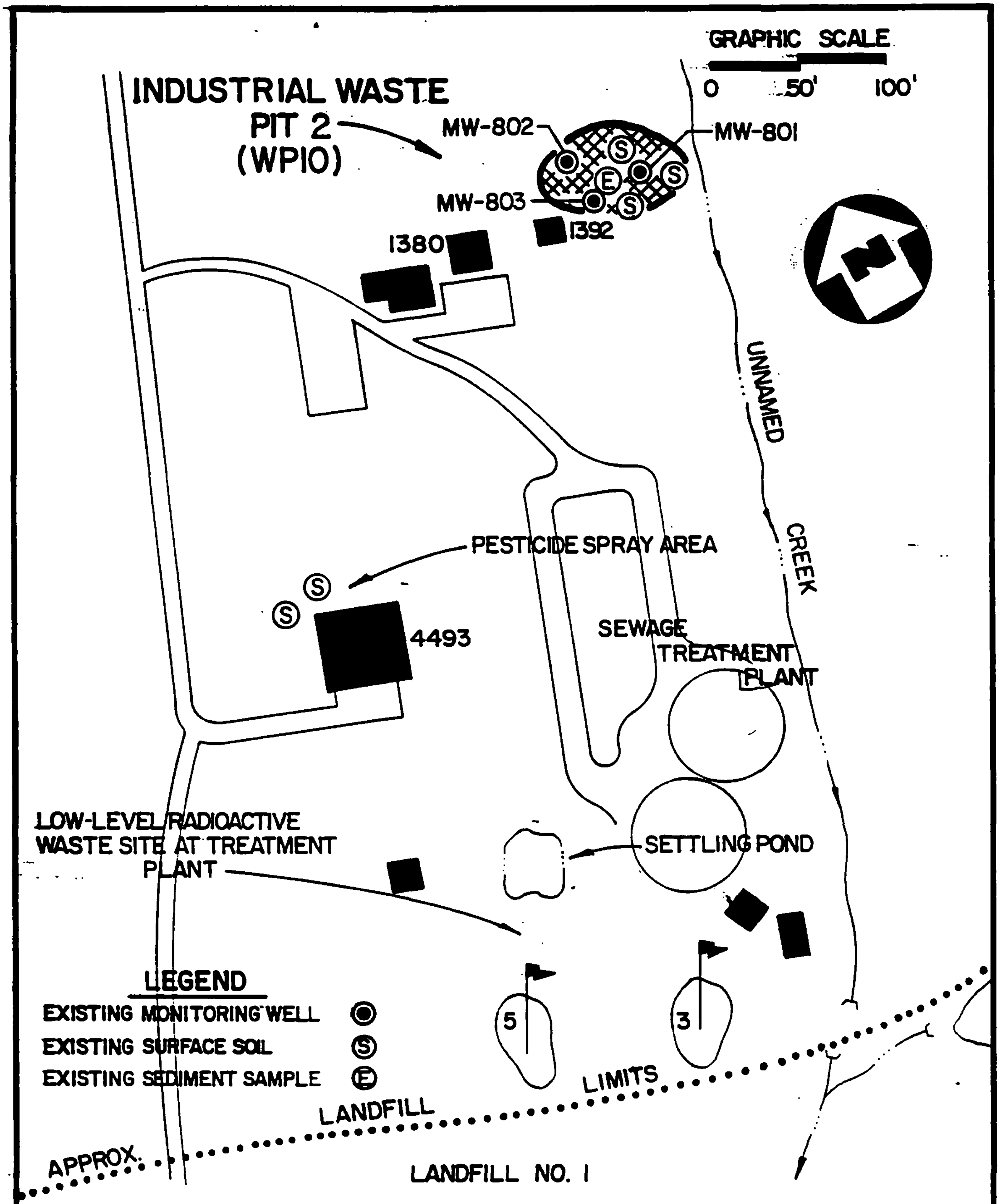
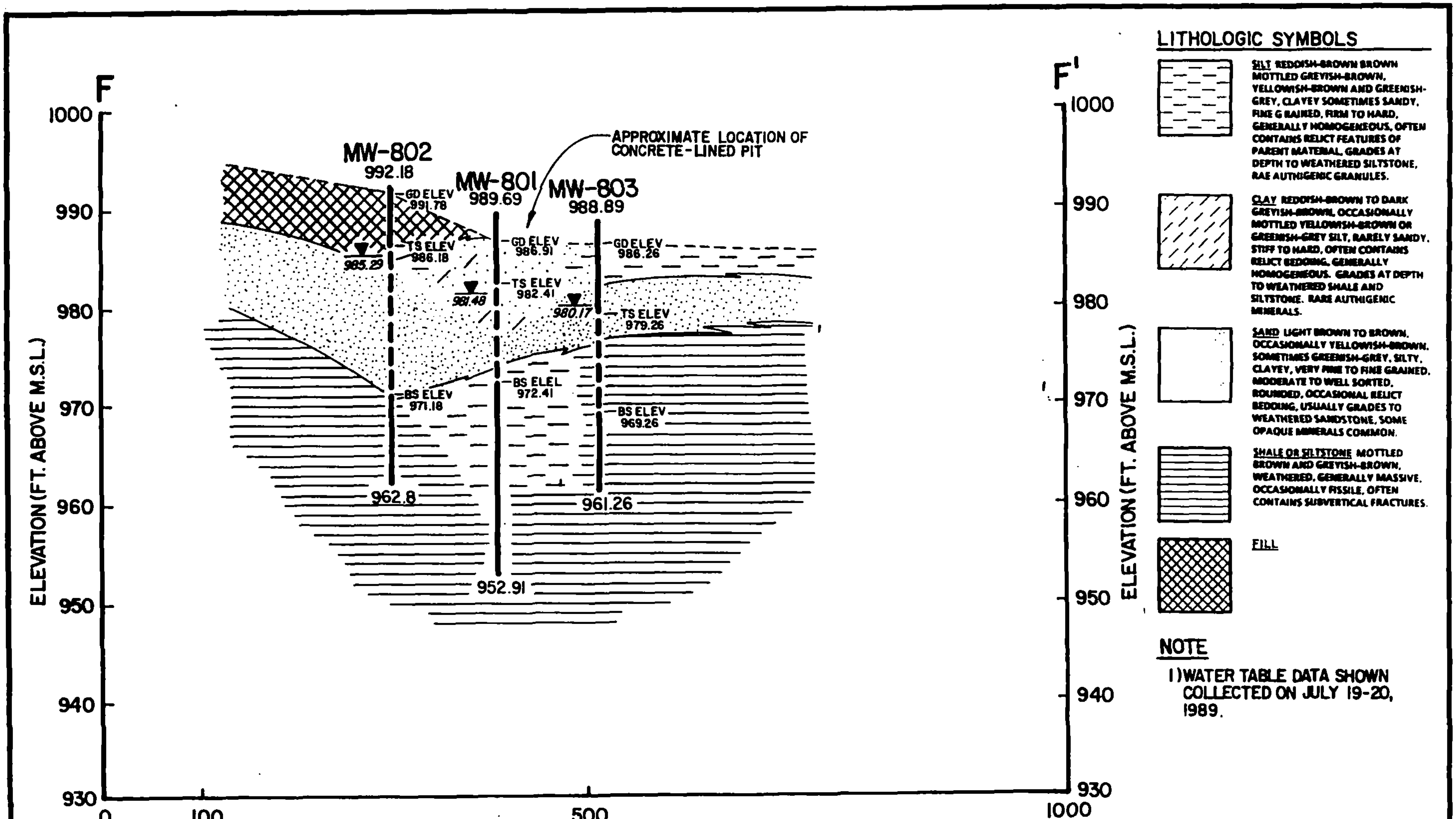


FIGURE 14-1
SITE PLAN
INDUSTRIAL WASTE PIT 2 (WP10)
SHEPPARD AIR FORCE BASE

NUS CORPORATION



PROFILE F-F'

VERTICAL EXAGGERATION 10X HORIZONTAL

FIGURE 14-2
PROFILE F-F'
INDUSTRIAL WASTE PIT 2 (WP10)
SHEPPARD AIR FORCE BASE
NUS CORPORATION

Ground water was encountered at a depth of about 10 feet in each boring. Upon well completion, the water levels stabilized at 5 to 6 feet below the ground surface. Shallow ground water at Site WP10 is apparently located within the sand and sandstone unit perched above the clay and siltstone. The water level in the wells was approximately the same as that in the neighboring creek. Water-level elevations indicate a strong gradient toward this creek (Figure I-5 in Appendix I). A slug test conducted in MW-801 indicated the hydraulic conductivity in the sandstone is 1.5×10^{-3} cm/sec.

14.3 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

14.3.1 Surface Soil

Two surface soil samples (SS-001 and SS-001A) were obtained from WP10 during the Round I investigation. The samples were collected in order to evaluate the potential public health hazards resulting from either direct contact with, or off-site migration of, site surface soil contaminants. Sample locations are shown on Figures I-6 and I-7 in Appendix I. Because the site history indicated that the waste pit was used for storage of waste oils and fuels, samples were analyzed for TCL VOCs, BNAs, and PCBs, and the Priority Pollutant metals. Sample-specific analytical results are displayed on Figures I-6 and I-7 (Appendix I) and summarized in Table 14-1.

The analytical results presented in Table 14-1 indicate that three semivolatile organics were detected in the surface soils: bis(2-ethylhexyl)phthalate, fluoranthene, and pyrene. The concentration of bis(2-ethylhexyl)phthalate detected in the surface soils (60 µg/kg) was less than that detected in background soil samples. The low-level PAH contamination (i.e., pyrene and fluoranthene) may be attributable to the storage (and burning) of fuels at the site. However, low-level PAH contamination is frequently detected in environmental samples as a result of the combustion of fuels (e.g., the use of motorized vehicles).

Results presented in Table 14-1 also indicate that the maximum concentrations of the following metals in the surface soil samples are five to ten times the base or regional background levels:

- Cadmium - (34.3 mg/kg)
- Chromium - (840 mg/kg)

R34892

TABLE 14-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10 - SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration(a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration(c)
Round I					
Bis(2-ethylhexyl)phthalate (µg/kg)	80	NA	1/2	60	30
Fluoranthene (µg/kg)	ND	NA	1/2	80	40
Pyrene (µg/kg)	ND	NA	1/2	80	40
Arsenic (mg/kg)	2	6.5	2/2	3-5.3	4.15
Cadmium (mg/kg)	ND	NA	1/2	34.3	17
Chromium (mg/kg)	10.9	80	2/2	10-840	425
Copper (mg/kg)	32.1	15	2/2	24.8-110	67.4
Lead (mg/kg)	6	31.5	2/2	32.4-180	106.2
Mercury (mg/kg)	0.4	0.04	2/2	0.21-0.6	0.405
Nickel (mg/kg)	27.7	37.5	2/2	12.3-38.4	25.35
Selenium (mg/kg)	ND	0.6	1/2	0.9	0.5
Sodium (mg/kg)	ND	7,000	1/2	260	130
Zinc (mg/kg)	36.2	33.5	2/2	33.4-450	241.7

TABLE 14-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10 - SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration(a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration(c)
Round II					
Di-n-butyl phthalate (µg/kg)	ND	NA	3/3	270E-550	366.7
Benzo(b)fluoranthene (µg/kg)	ND	NA	1/3	65E	21.7
Benzo(a)pyrene (µg/kg)	ND	NA	1/3	54E	18
Pyrene (µg/kg)	ND	NA	2/3	31E-42E	38
Alpha-chlordane (µg/kg)	ND	NA	1/3	2,300	766
Heptachlor epoxide (µg/kg)	ND	NA	1/3	42	14
4,4'-DDT (µg/kg)	ND	NA	3/3	61-1,100	697
4,4'-DDD (µg/kg)	ND	NA	1/3	50	17
4,4'-DDE (µg/kg)	ND	NA	2/3	56-1,400	485
Gamma-chlordane (µg/kg)	ND	NA	1/3	2,900	967
Arsenic (mg/kg)	2	6.5	3/3	1.6-3	2.4
Beryllium (mg/kg)	ND	1.5	3/3	0.49-0.6	0.55
Cadmium (mg/kg)	ND	NA	3/3	0.61-1.6	1.1

R34892

TABLE 14-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10 - SURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE THREE

Contaminant	Base Background Concentration[a]	Regional Background Concentration[b]	Number Detections/ Number Samples	Range of Concentrations	Average Concentration[c]
Round II (continued)					
Chromium (mg/kg)	10.9	80	3/3	9.5-16.5	12.8
Copper (mg/kg)	32.1	15	3/3	8-15.4	11.4
Lead (mg/kg)	6	31.5	3/3	14.7-89	46.5
Mercury (mg/kg)	0.4	0.04	1/3	1.7	0.6
Nickel (mg/kg)	27.7	37.5	3/3	8.3-12.3	9.9
Silver (mg/kg)	ND	1.6	2/3	1.1-2.4	1.2
Zinc (mg/kg)	36.2	33.5	3/3	28.9-99.8	62.2
pH (mg/kg)	NA	NA	3/3	6.8-7.6	7.2
CEC (meq/100g)	10.6	NA	1/1	24.5	24.5
Total organic carbon (meq/100g)	NA	NA	1/1	9,100	9,100

Notes: NA - not analyzed/not applicable.
ND - not detected.
E - estimated value.

(a) Average of two subsurface soil sampless collected on the base, not near any IRP site.
(b) Shacklette and Boerngen, 1984.
(c) Averages calculated using zero for nondetects.

- Lead - (180 mg/kg)
- Zinc - (450 mg/kg)

The maximum metals concentrations are associated with sample location SS-001. Generally, metals concentrations at sample location SS-001A, which is located downgradient of the site, are similar to base and/or published background soil levels.

Although pesticide analyses were not originally requested for the Round I surface soil samples, examination of the chromatograms for the PCB analyses revealed possible pesticide contamination. Since the analyses were not subject to second-column gas chromatograph (GC) confirmation, the pesticide contamination could not be positively identified or quantified.

Round II of the investigation was conducted to further examine the metals and suspected pesticide contamination. Three surface soils (SS-802A, SS-803A, and SS-804A) were collected at locations shown on Figure I-3 (Appendix I). These samples were submitted for laboratory analysis of TCL BNAs and pesticides, Priority Pollutant metals, total petroleum hydrocarbons (TPH), TOC, and CEC. Analytical results for the Round II investigation are summarized in Table 14-1. Four semivolatile organic compounds were detected in surface soil samples collected during the investigation (di-n-butyl phthalate, benzo(b)fluoranthene, benzo(a)pyrene, and pyrene). The low concentration of di-n-butyl phthalate may be attributable to the widespread use and disposal of plastic. As discussed previously, the low-level PAH concentrations are probably the result of the storage (and burning) of fuels at the site. In contrast to the Round I analytical results, metals concentrations in the surface soils are generally similar to background soil concentrations. Only the maximum concentration of lead detected in the surface soils is greater than five times the base background concentrations. The following pesticides were also detected:

- Gamma-chlordane - (C_{max} = 2,900 µg/kg)
- Alpha-chlordane - (C_{max} = 2,300 µg/kg)
- Heptachlor epoxide - (C_{max} = 42 µg/kg)
- 4,4'-DDT - (C_{max} = 1,100 µg/kg)
- 4,4'-DDD - (C_{max} = 50 µg/kg)
- 4,4'-DDE - (C_{max} = 1,400 µg/kg)

Historical use of pesticides at Sheppard AFB may have contributed to the pesticides detected in the surface soils at Site WP10. Figures I-6 and I-7 (Appendix I) illustrate the analytical results for the Round II samples.

14.3.2 Subsurface Soil

In 1988, two subsurface soil samples (SB-801A and SB-801B) were collected during the drilling for monitoring well MW-801. Samples were collected from depths of approximately 5 and 15 feet. Sample locations are shown on Figures I-6 and I-7 (Appendix I). The samples were submitted for laboratory analysis of TCL VOCs, BNAs, PCBs, and Priority Pollutant metals, to establish the presence or absence of contamination. The results of the Round I sampling and analysis of subsurface soils are summarized in Table 14-2. Two semivolatile organic compounds, 2-methylnapthalene (23,000 µg/kg) and phenanthrene (5,700 µg/kg), were reported in one of the subsurface soil samples. Reported concentrations for several metals are generally similar to published regional background concentrations. The reported concentrations of antimony and zinc exceed base or regional background concentrations. Although pesticide analyses were not originally scheduled for the subsurface soils, examination of the chromatograms for the PCB analyses indicated the possible presence of pesticides. These analyses were not subjected to second column GC confirmation. Consequently, the identification and quantification of the pesticides were suspect. Sample results for the Round I analyses are displayed on Figures I-6 and I-7.

Six subsurface soil samples were collected from two locations during Round II of the investigation in order to confirm the presence or absence of suspected pesticide contamination. In addition to pesticide analyses, samples were submitted for laboratory analysis of BNAs, the Priority Pollutant metals, and TPH. Sample locations for the Round II subsurface soils are shown in Figures I-6 and I-7 (Appendix I). The results of the subsurface soil sampling and analysis are summarized in Table 14-2. Di-n-butyl phthalate was reported in all six subsurface soil samples at concentrations of 120 µg/kg to 510 µg/kg. The concentration of bis(2-ethylhexyl)phthalate reported for one soil sample was less than that detected in the background soil sample. Antimony, cadmium, lead, mercury, silver, and zinc were detected in one or more subsurface soil samples at concentrations exceeding base or regional back ground

R34892

TABLE 14-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration (a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration(c)
Round I					
2-Methylnaphthalene (µg/kg)	ND	NA	1/2	23,000	11,500
Phenanthrene (µg/kg)	ND	NA	1/2	5,700	2,850
Antimony (mg/kg)	ND	1	2/2	11.1E-13.9E	12.5
Arsenic (mg/kg)	2	6.5	1/2	3	1.5
Beryllium (mg/kg)	ND	1.5	2/2	0.7-1.9	1.3
Chromium (mg/kg)	10.9	80	2/2	10.7-33.5	22.1
Copper (mg/kg)	32.1	15	2/2	51E-93.7E	72.35
Lead (mg/kg)	6	31.5	2/2	4.6-11.8	8.2
Mercury (mg/kg)	0.4	0.04	2/2	0.2	0.2
Nickel (mg/kg)	27.7	37.5	2/2	6.4-29	17.7
Zinc (mg/kg)	36.2	33.5	2/2	49.2E-240E	144.6
CEC (meq/100g)	10.6	NA	1/1	10.4	10.4

TABLE 14-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration (a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration(c)
Round II					
Bis(2-ethylhexyl)phthalate (µg/kg)	80	NA	1/6	18	3
Di-n-butyl phthalate (µg/kg)	ND	NA	6/6	120-510	284
Alpha-chlordane (µg/kg)	ND	NA	2/6	440-19,000	3,240
4,4'-DDT (µg/kg)	ND	NA	1/6	69	11.5
4,4'-DDD (µg/kg)	ND	NA	2/6	520-66,000	11,086
4,4'-DDE (µg/kg)	ND	NA	1/6	120	20
Gamma-chlordane (µg/kg)	ND	NA	2/6	460-17,000	2,910
Antimony (mg/kg)	ND	1	1/6	9.1	1.5
Arsenic (mg/kg)	2	6.5	6/6	0.37E-13.8E	6
Beryllium (mg/kg)	ND	1.5	5/6	0.34-0.66	0.4
Cadmium (mg/kg)	ND	NA	1/6	1.8	0.3
Chromium (mg/kg)	10.9	80	6/6	8.6-24.4	13.2
Copper (mg/kg)	32.1	15	6/6	4.5-67	19.9
Lead (mg/kg)	6	31.5	6/6	11E-141E	47.1

R34892

TABLE 14-2

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE THREE

Contaminant	Base Background Concentration (a)	Regional Background Concentration(b)	Number Detections/ Number Samples	Range of Concentrations	Average Concentration(c)
Round II (continued)					
Mercury (mg/kg)	0.4	0.04	1/6	4	0.7
Nickel (mg/kg)	27.7	37.5	6/6	10.5-18.4	14.4
Silver (mg/kg)	ND	0.6	3/6	1.1-7.3	1.8
Zinc (mg/kg)	36.2	33.5	4/6	27.4-194	58.2
pH	NA	NA	6/6	7.9-10.3	8.6
Petroleum hydrocarbons (mg/kg)	NA	NA	3/6	78-180	119
CEC (meq/100g)	10.6	NA	1/1	15.5	15.5

Notes: NA - not analyzed/not applicable.
ND - not detected.
E - estimated value.

(a) Average of two subsurface soil samples collected on base, not near any any IRP site.
(b) Shacklette and Boerngen, 1984.
(c) Averages calculated using zero for nondetects.

levels. Past pesticide application practices at the site may have contributed to the pesticides detected in the subsurface soils. However, it is noted that the detected pesticide concentrations are greater than the concentrations found in the surface soils or in soils sampled at other base locations. A pattern of pesticide contamination is shown, with the maximum concentrations occurring in the first 5 feet of subsurface soil, and decreasing with depth. Sample-specific analytical findings are displayed on Figures I-6 and I-7 in Appendix I.

14.3.3 Ground Water

Three monitoring wells (MW-801, MW-802, and MW-803) were installed at Site WP10 to investigate for potential contamination of ground water resulting from the storage or disposal of hazardous materials/wastes (fuels and oils). A ground-water sample was collected during Round I from MW-801 and analyzed for TCL VOCs, BNAs, and PCBs, as well as the Priority Pollutant metals and selected radiological parameters. Ground-water samples were collected from all three wells during the Round II investigation and analyzed for TCL VOCs, BNAs, and pesticides, Priority Pollutant metals, and TPH.

Analytical results for the Round I and II investigations are summarized in Tables 14-3, 14-4, 14-5, 14-6, and displayed Figure I-8 in Appendix I. Organic contaminants were not detected in the Round I ground-water sample. Two metals (arsenic and selenium) were detected at concentrations well below MCLs or proposed MCLs. Three volatile organic compounds (benzene, 1,2-dichloroethene, and trichloroethene) were found in the Round II ground-water samples at concentrations below MCLs. Low levels of the following metals, phthalate esters, and pesticides were also reported in the Phase II ground-water samples:

- Arsenic (C_{max} = 17.7 µg/L)
- Nickel (C_{max} = 16 µg/L)
- Selenium (C_{max} = 5.7 µg/L)
- Di-n-butyl phthalate (C_{max} = 1 µg/L)
- Diethyl phthalate (C_{max} = 0.7 µg/L)
- Alpha-chlordane (C_{max} = 2.7 µg/L)
- Beta - BHC (C_{max} = 0.21 µg/L)
- Heptachlor (C_{max} = 0.15 µg/L)

R34892

TABLE 14-3

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10-GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentration	Average Concentration[b]	Standard/Criteria
Round I					
Arsenic (μg/L)	ND	1/1	4.18	4.18	50[c]
Selenium (μg/L)	4.17	1/1	2.63	2.63	10[c]
Round II					
Benzene (μg/L)	ND	2/3	1E-2E	1.0	5[d]
1,2-Dichloroethane (μg/L)	ND	1/3	1E	0.3	5[d]
Trichloroethene (μg/L)	ND	1/3	1E	0.3	5[d]
Di-n-butyl phthalate (μg/L)	ND	1/3	1E	0.3	NA
Diethyl phthalate (μg/L)	ND	1/3	0.7E	0.2	NA
Alpha-chlordane (μg/L)	ND	2/3	2.5-2.7	1.7	2[e]
Beta-BHC (μg/L)	ND	1/3	0.21	0.1	NA
Heptachlor (μg/L)	ND	1/3	0.15	0.1	0.4[e]
4,4'-DDD (μg/L)	ND	1/3	0.42	0.1	NA

TABLE 14-3

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE WP10-GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
PAGE TWO

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentration	Average Concentration[b]	Standard/Criteria
Round II (continued)					
Gamma-chlordane (µg/L)	ND	2/3	1.8-2.0	1.3	2[e]
Arsenic (µg/L)	ND	3/3	13.1-17.7	16	50[c]
Nickel (µg/L)	ND	1/3	16	5.3	100[f]
Selenium (µg/L)	4.17	1/3	5.7E	1.9	10[c]

Notes: ND - not detected.
NA - not available.
E - estimated value.

(a) Results reported are for one ground-water sample collected on the base, not near any IRP site.
(b) Averages calculated using zero for nondetects.
(c) NIPDWR (National Interim Primary Drinking Water Regulation) Standard.
(d) MCL.
(e) 40 CFR Parts 141, 142 and 143 (5/89) (Proposed Standards).
(f) USEPA, October 1989.

TABLE 14-4

GROUND-WATER ANALYTICAL DATA
WP10 - INDUSTRIAL WASTE PIT
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Alpha Chlordane (µg/l)	Arsenic (µg/l)	Benzene (µg/l)	Beta BHC (µg/l)	DDD (µg/l)	Diethylphthalate (µg/l)	Di-n-Butyl Phthalate (µg/l)	1,2-Dichloroethene (µg/l)	Gamma Chlordane (µg/l)	Heptachlor (µg/l)	Nickel (µg/l)	Selenium (µg/l)	Trichloroethene (µg/l)
SH08-GW-MW801-A	12/19/88	--	4 18	--	--	--	--	--	2 63	--	--	--	2.63	--
SH08-GW-MW801-B	07/17/89	--	17.7	2E	0.21	--	--	--	--	--	--	--	--	--
SH08-GW-MW802-A	07/18/89	--	17.2	--	--	--	--	--	--	--	--	16	5.7E	1E
SH08-GW-MW-802AD	07/18/89	2.5	--	--	--	--	--	--	--	1.8	--	--	--	--
SH08-GW-MW803-A	07/18/89	2.7	13.1	1E	--	0 42	0 7E	1E	1E	2.0	0 15	--	--	--

Notes: E - estimated value.
(--) - analytical results below Contract Required Detection Limits (CRDLs)

TABLE 14-5

SURFACE AND SUBSURFACE SOIL ANALYTICAL DATA - PESTICIDES ONLY
WP10 - INDUSTRIAL WASTE PIT - PHASE II SAMPLING
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Sample Depth (feet)	DDT (μg/kg)	DDE (μg/kg)	DDD (μg/kg)	Alpha Chlordane (μg/kg)	Gamma Chlordane (μg/kg)	Heptachlor Epoxide (μg/kg)
SURFACE SOILS								
SH08-SS-SS802-A	07/15/89	0-0.5	1,100	1,400	--	--	--	42
SH08-SS-SS803-A	07/15/89	0-0.5	61	56	50	--	--	--
SH08-SS-SS804-A	07/15/89	0-0.5	930	--	--	2,300	2,900	--
SUBSURFACE SOILS								
SH08-SU-MW802-A	07/14/89	5	69	120	--	--	--	--
SH08-SU-MW802-B	07/14/89	10	--	--	--	--	--	--
SH08-SU-MW802-C	07/14/89	20	--	--	--	--	--	--
SH08-SU-MW803-A	07/14/89	5	--	--	66,000	19,000	17,000	--
SH08-SU-MW803-B	07/14/89	10	--	--	520	440	460	--
SH08-SU-MW803-C	07/14/89	11.5	--	--	--	--	--	--

Note: (--) - analytical results below Contract Required Detection Limits (CRDLs).

TABLE 14-6

SURFACE AND SUBSURFACE SOIL ANALYTICAL DATA
WP10 - INDUSTRIAL WASTE PIT
SHEPPARD AIR FORCE BASE, TEXAS

Sample Number	Date Sampled	Bis(2-ethyl-hexyl) phthalate (µg/kg)	Di-n-butyl phthalate (µg/kg)	Fluoranthene (µg/kg)	Benzo (B) Flouranthene (µg/kg)	Pyrene (µg/kg)	Benzo (A) Pyrene (µg/kg)	Arsenic (µg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Zinc (mg/kg)
SURFACE SOIL																			
SH08-SS-SS001-A	12/20/88	60	--	80	--	80	--	3	--	--	10	24.8	32.4	0.21	12.3	--	--	--	33.4
SH08-SS-SS001-1	12/09/88	--	--	--	--	--	--	5 3	34 3	34 3	840	110	180	0 6	38.4	0 9	--	260	450
SH08-SS-SS802A	07/15/89	--	550	--	65E	31E	54E	2 7E	0 6	1 1	16 5	10.9	89E	--	9 2	--	2 4	--	57.9
SH08-SS-SS803A	07/15/89	--	280E	--	--	.	--	3E	0 49	0 61	9 5	8	14.7E	--	8 3	--	--	--	28.9
SH08-SS-SS804A	07/15/89	--	270E	--	--	--	--	1 6E	0 56	1 6	12.3	15.4	35.7E	1.7	12 3	--	1.1	--	99.8

Sample Number	Date Sampled	Sample Depth (feet)	2-methyl naphthalene (µg/kg)	Bis(2-ethyl-hexyl) phthalate (µg/kg)	Di-n-butyl phthalate (µg/kg)	Phenol (µg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)
SUBSURFACE SOIL																	
SH08-SU-SB801-A	12/06/88	6	23,000	--	--	5,700	11 1E	3	0 7	--	10.7	93.7E	11 8	0.2	6 4	--	240E
SH08-SU-SB801-B	12/06/88	15	--	--	--	--	13 9E	--	1 9	--	33.5	51E	46	0 2	29	--	49 2
SH08-SU-MW802-A	07/14/90	5	--	--	330	--	--	18 8E	0 66	--	10.3	6.7	23 2E	--	10.5	1 1	--
SH08-SU-MW802-B	07/14/89	10	--	--	380	--	9 1E	13E	0 35	--	9.8	8.8	19.4E	--	12	--	--
SH08-SU-MW802-C	07/14/89	20	--	--	120E	--	--	0 37E	0 34	--	9.8	4.5	11 9E	--	15.8	--	30.6
SH08-SU-MW803-A	07/14/89	5	--	18E	510	--	--	1 8E	0 61	1.8	24.4	67.0	141E	4	15.7	7.3	194
SH08-SU-MW803-B	07/14/89	10	--	--	236E	--	--	1 2E	--	--	8.6	12 4	11E	--	13 8	2.3	27 4
SH08-SU-MW803-C	07/14/89	11 5	--	--	130E	--	--	5 9E	0 44	--	16 3	19 7	76 4E	--	18.4	--	96 9

Notes: E - estimated value
(--) - analytical results below Contract Required Detection Limits (CRDLs).

- 4,4' - DDD (C_{max} = 0.42 µg/L)
- Gamma-chlordane (C_{max} = 2.0 µg/L)

Only the level of chlordane exceeds (marginally) a proposed MCL.

14.4 POTENTIAL PUBLIC HEALTH RISKS

This section discusses the potential public health risks associated with human exposure to selected indicator compounds detected in the environmental media at Site WP10. Risk assessment methodology used to calculate exposure doses and risks is presented in Section 4.0.

Surface/Subsurface Soils

There is limited evidence of the disposal (or burning) of fuels, metals-containing wastes, and pesticides at Site WP10. Cadmium, chromium, lead, and zinc were detected in one Round I surface soil sample at concentrations at least five times the base or regional background levels. The concentrations of antimony, lead, and mercury were also elevated in one or more subsurface soil samples. The following pesticides were detected in at least one surface or subsurface soil sample at concentrations exceeding 1,000 µg/kg:

- Alpha-chlordane
- 4,4-DDT
- 4,4-DDE
- Gamma-chlordane
- 4,4-DDD

Generally, only low concentrations of phthalates and PAHs were detected in the site surface soils; the concentrations found are similar to those found at other sites investigated at Sheppard AFB and those commonly detected in the environment as a result of the widespread use of fuels and plastics.

Site WP10 is within 1,000 feet of a residential area west of the site and adjacent to the base golf course. Consequently, residents from the area as well as base personnel may occasionally come in contact with the contaminated surface soils at the site. Table 14-7 summarizes the estimated potential carcinogenic risks and hazard quotients, assuming that a receptor is occasionally exposed (via dermal contact with or accidental ingestion of soils) to the pesticides and metals in the surface soils. Under the conditions established for the risk assessment, the estimated excess lifetime cancer risk is 2.8×10^{-6} under the worst-case scenario. The total Hazard Index calculated for both an adult and an adolescent receptor never exceeds unity; therefore, adverse noncarcinogenic health effects are not anticipated.

Ground Water

There is limited evidence of site impacts on the ground water at Site WP10. Low concentrations of volatile organics, phthalates, and pesticides were sporadically detected in the Round II ground-water samples. However, only total chlordane (maximum concentration of alpha-chlordane added to the maximum concentration of gamma-chlordane) was detected in monitoring wells at concentrations exceeding the proposed MCL of 2 µg/L. The following table summarizes the risk assessment results, assuming that an individual is exposed to maximum (worst-case) and average (plausible-case) chlordane concentrations detected in the Round II monitoring well samples (i.e., the individual routinely ingests water containing the elevated chlordane concentrations):

Chlordane Concentration	Excess Lifetime Cancer Risk	Hazard Quotient
4.7 µg/L	1.7×10^{-4}	2.2
2.3 µg/L	8.5×10^{-5}	1.1

The estimated excess lifetime cancer risk for the worst-case scenario (maximum chlordane concentration) exceeds 1×10^{-4}, which is the upper-bound limit of acceptable risks. Additionally, the Hazard Quotient exceeds unity when either the maximum or average contaminant concentrations are assessed; thus, adverse noncarcinogenic health effects are possible under the conditions established in the risk assessment. As discussed previously, however, the shallow ground water underlying Site WP10 is not currently used as a domestic water supply source; the risks presented above are for a hypothetical human receptor who may utilize the ground water at some time in the future. Realistically, future use of the ground

TABLE 14-7

RISK ANALYSIS SUMMARY
SURFACE SOIL EXPOSURES[a]
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Exposure Route	Total Excess Lifetime Cancer Risk		Total Hazard Index	
	Worst Case[b]	Plausible Case[c]	Worst Case[b]	Plausible Case[c]
Accidental Ingestion of Soils - Adult	5.6×10^{-7}	5.3×10^{-7}	2.2×10^{-1}	1.6×10^{-1}
Accidental Ingestion of soils - 45 Kg Child	-	-	4.7×10^{-2}	3.3×10^{-2}
Dermal Contact with Surface Soils - Adult	2.8×10^{-6}	2.7×10^{-6}	2.2×10^{-1}	2.2×10^{-1}
Dermal Contact with Surface Soils - 45 Kg Child	-	-	3.8×10^{-2}	3.8×10^{-2}

(a) Includes cadmium, chromium, lead, and zinc, and the pesticides.
(b) Worst-case assessment evaluated maximum contaminant concentrations.
(c) Plausible-case assessment evaluated average metals concentrations and average pesticide concentrations (average of positive detections only).

water is unlikely because the ground water is of limited quality (the concentrations of TDS and many common anions are high) and quantity.

14.5 RECOMMENDATIONS

The remedial investigation indicates that there is some limited evidence of past waste storage and disposal at Site WP10. The risk assessment results indicate that occasional exposure to the pesticides and metals in the surface soils would not result in adverse noncarcinogenic effects or unacceptable cancer risks. However, based on pesticide levels in the ground water, cancer risks in excess of 1×10^{-4} are estimated for an individual using the ground water as a domestic water supply source. The pesticide contamination detected in the ground water must be evaluated in light of the following facts:

- Shallow ground-water at Sheppard AFB is not currently used as a domestic water supply source, and future use is unlikely.

- Although the majority of the risk estimated for domestic use of the ground water is attributable to chlordane, the maximum concentration is two times the proposed MCL of 2 µg/L.

- Pesticides are relatively persistent compounds, which tend to adsorb to soils. In contrast to volatile organics such as benzene, pesticides generally do not readily migrate via ground-water transport.

It is recommended that Site WP10 shallow ground water never become a domestic drinking water source. In the unlikely event ground water near WP10 is considered for a domestic water supply source, it should not be accomplished unless future testing reveals a drop in in the chlordane level to within the MCL. It is further recommended that the probable source of contamination be removed. Removal would consist of severing and sealing the connection between the oil/water separator and the waste pit and managing the oil/water separator so that overflow does not occur. The concrete-lined pond could then be filled with low permeability material, such as clay. As a final conservative precaution, it is recommended that the fence currently enclosing much of the area including Site WP10 be maintained.

15

15.0 SITE OT11 - PESTICIDE SPRAY AREA

15.1 SITE BACKGROUND AND HISTORY

In the past, pesticide applications have been performed by the Entomology Shop, Golf Course Maintenance, and the Roads and Grounds Shop. In 1979, the responsibility for pesticide application around the base areas other than the golf course was delegated to the Golf Course Maintenance Shop. Golf Course Maintenance has always been located in Building 4493 adjacent to the waste treatment plant (Figure 15-1). This building has been used for both storing and mixing the pesticide chemicals. Rinse water generated from cleaning the application equipment and empty containers was sprayed on a gravel lot adjacent to the building. A storm drain in the vicinity empties directly into the sewage treatment plant. Rinsed containers were crushed and disposed of with general refuse.

15.2 SUBSURFACE INVESTIGATION

The subsurface investigation performed at the site was limited because surface soils were the primary medium of concern. Two sample locations were selected where pesticide containers were rinsed and emptied. Shelby tube samples were collected at depths of 0 to 4 feet. The samples indicated that the site is underlain by reddish-brown clayey silt, typical of the residual soil elsewhere on the base. Figures I-4 (Appendix I) and 14-2 (page 14-3) illustrate the subsurface material encountered at nearby sites.

No ground water was encountered in the shallow borings. Ground water beneath the site probably flows southward, toward the creek that runs through the golf course. The ground-water level, as interpreted from nearby monitoring wells, is probably at a depth of about 10 feet. Figure I-5 (Appendix I) illustrates ground-water elevations in the vicinity of the site.

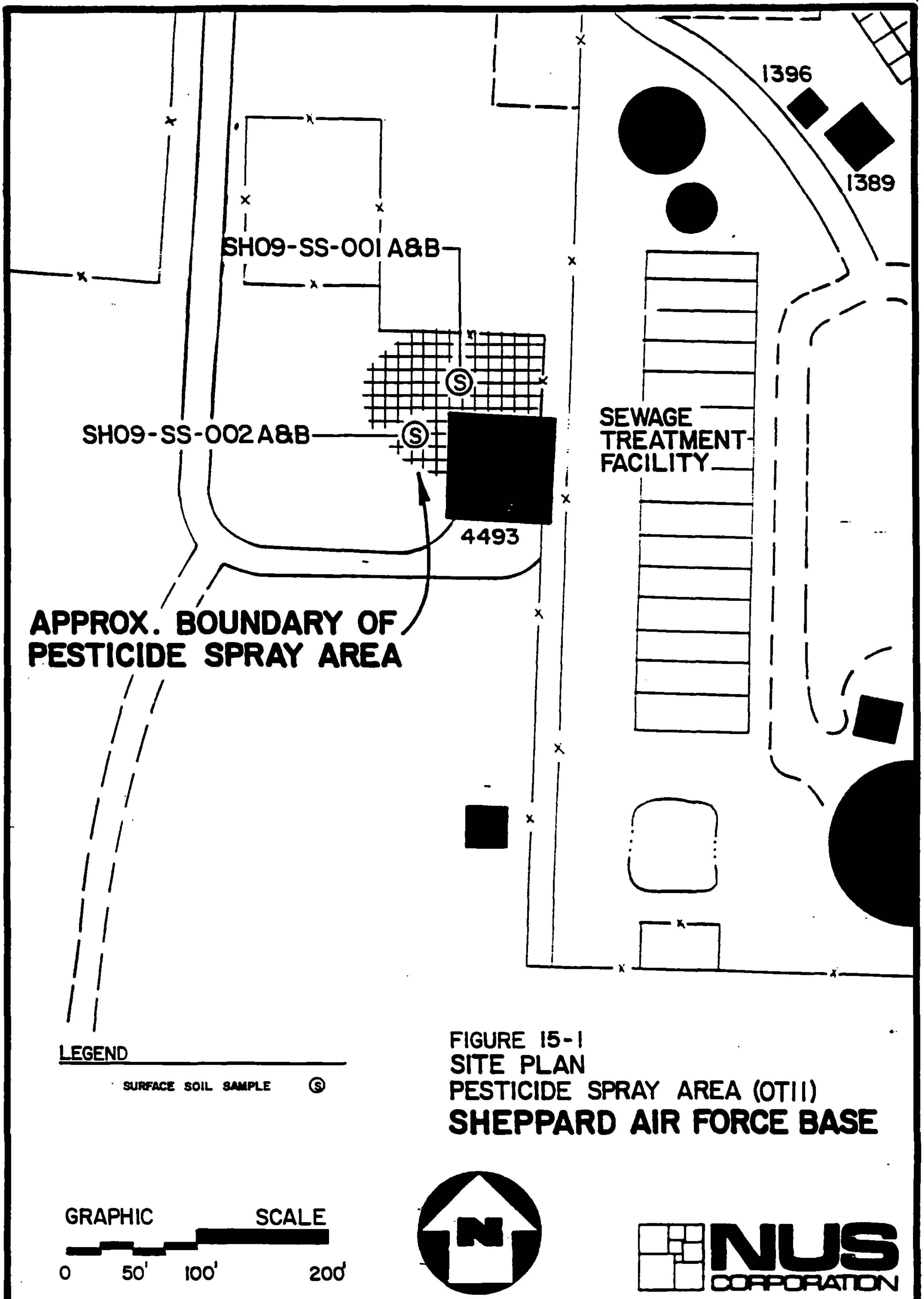


FIGURE 15-1
SITE PLAN
PESTICIDE SPRAY AREA (OT11)
SHEPPARD AIR FORCE BASE

15.3 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

15.3.1 Surface Soils

During the site investigation, four surface soil samples were collected from two locations at Site OT11 to investigate for the presence of residual pesticide contamination. The sample locations were selected based upon areas where base personnel were observed dumping their rinsewater. The samples were analyzed for TCL pesticides and chlorinated herbicides. The analytical results indicate that current and past activities at the Pesticide Spray Area have not resulted in contamination of the soil at the locations sampled. No pesticides or herbicides were detected in any of the soil samples; therefore, a second phase of sampling was not conducted at Site OT11.

15.4 POTENTIAL PUBLIC HEALTH RISKS

As evidenced by the lack of pesticide/herbicide contamination at Site OT11, current and past activities at the Pesticide Spray Area do not appear to have resulted in surface soil contamination that could pose a threat to public health or the environment. Consequently, a risk assessment was not performed for this site.

15.5 RECOMMENDATIONS

Based on the field observations and analytical data, it is recommended that this site be removed from further consideration under the IRP.

16

16.0 SITE ST13 - FORMER UNDERGROUND TANK SITE

16.1 SITE BACKGROUND AND HISTORY

Site ST13 was formerly a service station that dispensed fuels from two steel 5,000-gallon underground storage tanks (USTs) that contained gasoline and diesel fuel. The tanks were installed in the 1940s and were deactivitated in 1972. In 1989 the tanks were removed and were observed to be badly corroded. Hydrocarbon fuel odor was reported to be very strong in the vicinity of the tank pit, and grab samples of the soil were analyzed and found to contain low concentrations of petroleum hydrocarbons. The tank pit was the lined with polyethylene sheeting, and the backfill was returned to the tank pit.

16.2 GEOPHYSICAL INVESTIGATION

NUS used an EDA Instruments Omni IV magnetometer in an attempt to locate the USTs before they were removed. However, overhead power lines and underground utilities rendered the data inconclusive.

16.3 HYDROGEOLOGIC INVESTIGATION

Four borings were drilled at the site to obtain subsurface soil samples for laboratory analyses, to determine the site-specific geology, and to provide borings for monitoring well installation. The borings were located around the former tank pit at the locations shown on Figure 16-1. The borings were placed as close to the tank pit as possible, although access was limited by overhead power lines and underground utilities. The borings were completed at depths ranging from 30 to 35 feet.

The subsurface materials at the site consisted of mixed fill material, clayey sand, and weathered siltstone of the Petrolia Formation. Approximately 10 feet of fill, consisting of reddish-brown, sandy, clayey silt and silty-sand fill with occasional

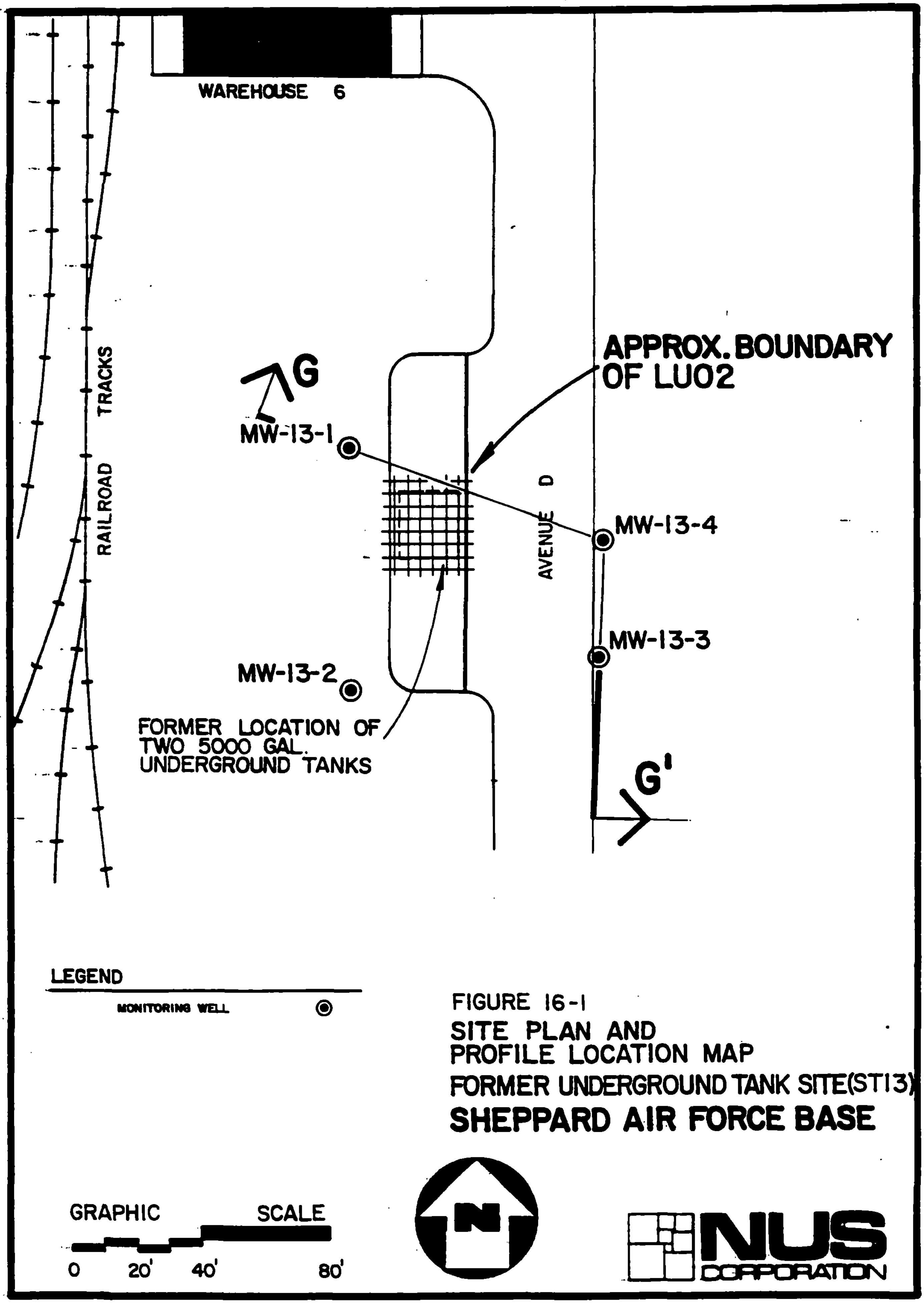


FIGURE 16-1
SITE PLAN AND
PROFILE LOCATION MAP
FORMER UNDERGROUND TANK SITE(ST13)
SHEPPARD AIR FORCE BASE

weathered rock fragments and cinders, was found in each boring. The fill was apparently used to bring Avenue D and the railroad to the same approximate grade. The fill appeared to be predominantly natural material derived from elsewhere on the base.

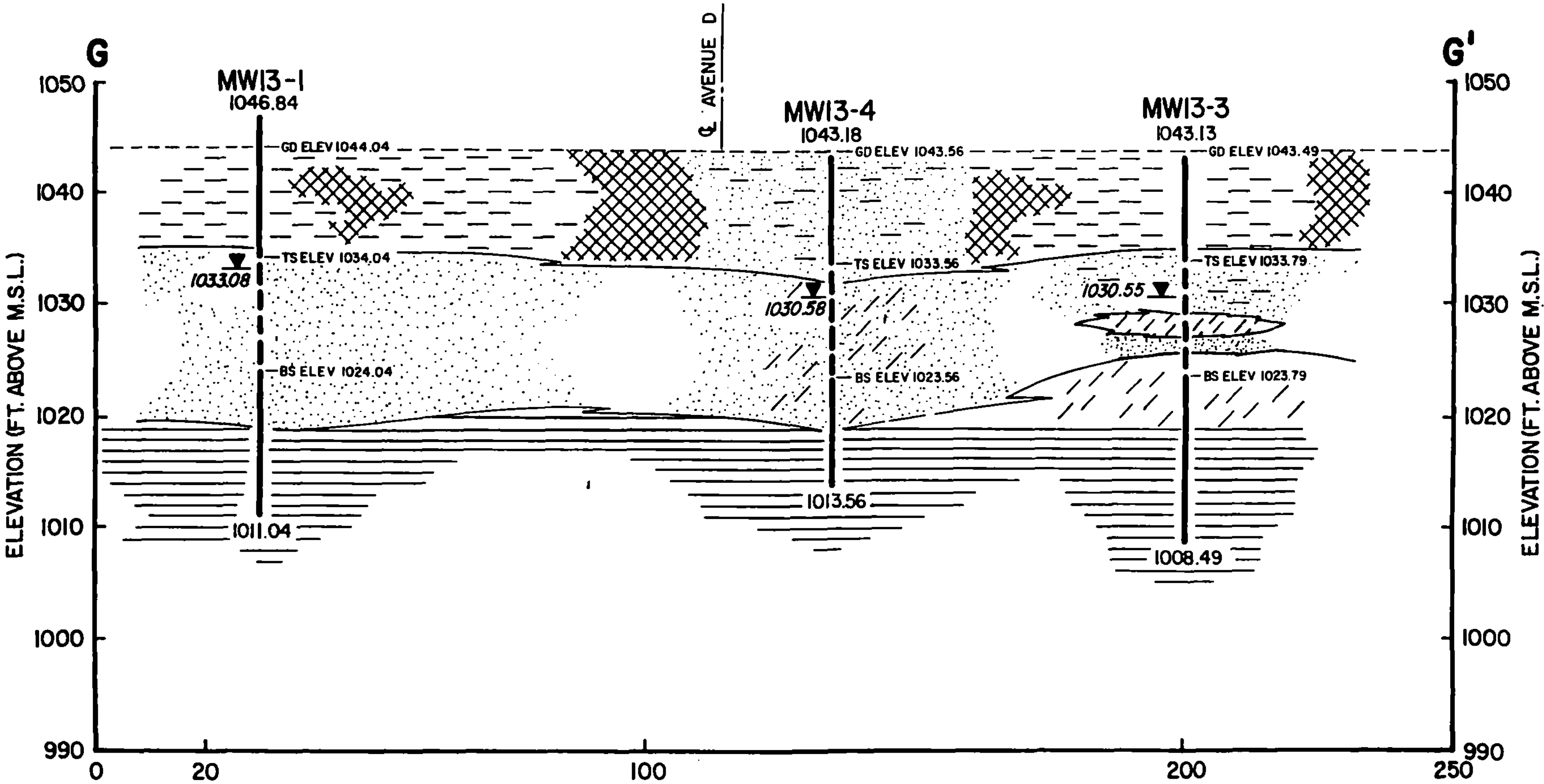
Beneath the fill is found 5 to 14 feet of clayey sand and weathered sandstone. The sand is fine grained, moderately sorted, and rounded, and is moist or wet in all borings below a depth of about 15 to 17 feet. The sand is underlain by reddish- or grayish-brown weathered siltstone and clay. Figure 16-2 is a cross section that presents the subsurface data.

Ground water was encountered in the sand in all borings, and each was completed as a monitoring well. The underlying clayey sand appeared slightly moist or dry and apparently acts as an aquitard to downward migration of ground water. Upon well completion, the water levels stabilized at about 10 to 12 feet below ground surface across the site. Water-level measurements were used to generate a potentiometric surface map for the site (Figure 16-3). Ground water flows through the clayey sand and sandstone toward the southeast, generally in the direction of surface water flow.

16.4 OCCURRENCE AND DISTRIBUTION OF CONTAMINATION

16.4.1 Subsurface Soils

During the site investigation, four subsurface soil samples (and one duplicate sample) were collected and analyzed for TCL VOCs and PAHs. Selected samples were also analyzed for TOC and CEC. Sample-specific analytical results are summarized in Table 16-1. No organic contaminants were detected in the subsurface soil samples. The TOC concentrations ranged from 66 to 2,500 mg/kg which indicates a wide variation in the carbon content of the subsurface soil samples. Although petroleum hydrocarbon contamination may increase the TOC content of a soil, TOC levels also vary naturally in soils. Consequently, this parameter cannot be used to conclusively demonstrate petroleum hydrocarbon contamination at a site. CEC values for the soil samples ranged from 13.1 to 27.0 meq/100 grams of soil and are typical of an average soil. Because organics typically associated with fuel oil contamination were not detected during the subsurface soil investigation, a second RI sampling phase was not conducted at Site ST13.



PROFILE G-G'

VERTICAL EXAGGERATION 2 X HORIZONTAL

LITHOLOGIC SYMBOLS

SILT REDDISH-BROWN BROWN MOTTLED GREYISH-BROWN, YELLOWISH-BROWN AND GREENISH-GREY, CLAYEY SOMETIMES SANDY, FINE G RAINED, FIRM TO HARD, GENERALLY HOMOGENEOUS, OFTEN CONTAINS RELICT FEATURES OF PARENT MATERIAL, GRADES AT DEPTH TO WEATHERED SILTSTONE, RAE AUTHIGENIC GRANULES

CLAY REDDISH-BROWN TO DARK GREYISH-BROWN, OCCASIONALLY MOTTLED YELLOWISH-BROWN OR GREENISH-GREY SILT, RARELY SANDY, STIFF TO HARD. OFTEN CONTAINS RELICT BEDDING. GENERALLY HOMOGENEOUS. GRADES AT DEPTH TO WEATHERED SHALE AND SILTSTONE. RARE AUTHIGENIC MINERALS.

SAND LIGHT BROWN TO BROWN, OCCASIONALLY YELLOWISH-BROWN, SOMETIMES GREENISH-GREY. SILTY, CLAYEY, VERY FINE TO FINE GRAINED. MODERATE TO WELL SORTED, ROUNDED, OCCASIONAL RELICT BEDDING, USUALLY GRADES TO WEATHERED SANDSTONE, SOME OPAQUE MINERALS COMMON

SHALE OR SILTSTONE MOTTLED BROWN AND GREYISH-BROWN, WEATHERED, GENERALLY MASSIVE, OCCASIONALLY FISSILE, OFTEN CONTAINS SUBVERTICAL FRACTURES.

FILL

NOTE

1) WATER TABLE DATA SHOWN COLLECTED ON JULY 19-20, 1989.

FIGURE 16-2
PROFILE G-G'
FORMER TANK SITE (ST13)
SHEPPARD AIR FORCE BASE

NUS CORPORATION

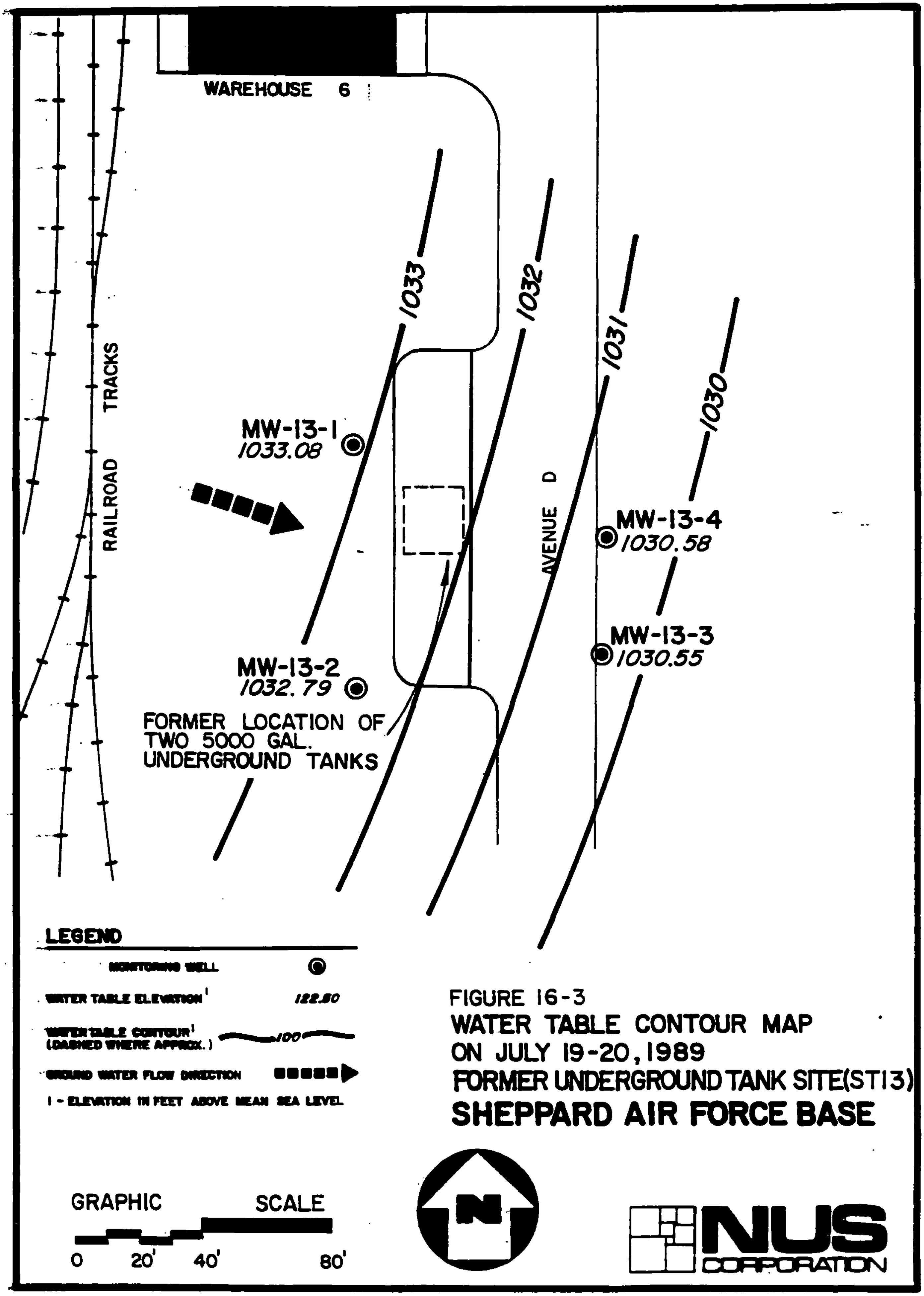


FIGURE 16-3
WATER TABLE CONTOUR MAP
ON JULY 19-20, 1989
FORMER UNDERGROUND TANK SITE (ST13)
SHEPPARD AIR FORCE BASE

TABLE 16-1

OCCURRENCE AND DISTRIBUTION OF CONTAMINATION
SITE ST13 - SUBSURFACE SOILS
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Number Detections/ Number Samples	Range of Concentrations	Average Concentration
pH	5/5	7.0 - 7.9	7.54
CEC (meq/100g)	3/3	13.1 - 27.0	20.7
TOC (mg/kg)	3/3	66.0 - 2,500	1,455

16.4.2 Ground Water

Ground-water samples were collected from the four monitoring wells and analyzed for TCL VOCs, lead, and TPH. Results are summarized in Table 16-2. TPH and lead were not detected in the ground water. The benzene concentration detected in one monitoring well (1µg/L) was less than the MCL (5 µg/L). No other organic contaminants were detected in the ground water. Because contaminant concentrations were so low, a second round of ground-water samples was not collected at Site ST13.

16.5 POTENTIAL PUBLIC HEALTH RISKS

The analytical results presented in Section 16.4 are not indicative of widespread fuel oil contamination at or migrating from Site ST13. Organic compounds typical of fuel oil contamination were not detected in the subsurface soil samples. Benzene, a known human carcinogen, was detected in one site monitoring well and is possible evidence of fuel-related contamination. However, the concentration of 1 µg/L is below the MCL (5 µg/L). Additionally, the low-level contamination is unlikely to migrate in concentrations significant enough to pose any health threat to human or ecological receptors. In summary, the site investigation and analyses of environmental samples collected at the former underground tank site indicate that the past storage of fuels does not pose a threat to the public health or the environment.

16.6 RECOMMENDATIONS

It is recommended that no further action be taken at this site and that this site be removed from further consideration under the IRP.

TABLE 16-2

OCCURRENCE AND DISTRIBUTION SUMMARY OF CONTAMINATION
SITE ST13 - GROUND WATER
SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS

Contaminant	Base Background Concentration[a]	Number Detections/ Number Samples	Range of Concentration	Standard/ Criteria
Benzene	ND	1/4	1 µg/L	5 µg/L[a]

(a) Results from one ground-water sample collected on base, not near any IRP site.

REFERENCES

REFERENCES

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Site Specific Investigations
& Studies

US AIR FORCE
INSTALLATION RESTORATION PROGRAM

X-Ref SA Vol #1

REMEDIAL INVESTIGATION REPORT

SHEPPARD AFB, TEXAS

TX 3571524161

AIR TRAINING COMMAND

VOLUME II: APPENDICES

HEADQUARTERS AIR TRAINING COMMAND/DEEV
RANDOLPH AFB, TEXAS

OCTOBER 1990

A

APPENDIX A

BORING LOGS

[redacted]

APPENDIX A

BORING LOGS

BORING LOG | **NUS CORPORATION**

PROJECT: SAFD | BORING NO.: SB201

PROJECT NO.: 7163 | DATE: 11/8/88 | DRILLER: G. Pool

ELEVATION: 1005.49 | FIELD GEOLOGIST: J. Wedekind

WATER LEVEL DATA: 17.73 BTOC

(Date, Time & Conditions) 1402, WARM, SUNNY Temp ~ 80°

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS/ 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCKS	REMARKS
									ΔHNu
						DK BRN	Topsoil and SILT CLY, w/ roots	ML	CAUGHT CUTTINGS
	4								0ppm
					HARD	DK BRN RDSH	4-5.3 CLAY, SILTY, sl SNDY	CL/ML	
				5.3					
CORE #1					M. HARD	YELSH BRN -	SANDSTONE F GRAINED	BL	0ppm
						WHTSH BRN	WELL SORTED, M. CONSOLIDATED MASSIVE		
	9'		2.4/5						
CORE 2									
					M. SOFT		SANDSTONE, w/ SILT MATRIX	BL	SOME SOFT BEDDING PLANES
	14'		3.2/5			LT GREY-BRN	FINE GRAINED, WELL SORTED POORLY CONSOLIDATED		0ppm
CORE # 3									
	19'		4/5		M. SOFT	LT. GREY	SANDSTONE, SILTY MATRIX	BL	CLAY-FILLED SUBVERTICAL FRACTURE
					-HARD		FINE GRAINED, WELL SORTED		@ 16-17' 0ppm
CORE #4									Core #4 is
							SANDSTONE AS ABOVE	BR	a 10' core barrel
				55			EXCEPT CROSS BEDDED		- STRAINED FRACTURES
	25'						w/ ABUNDANT OPAQUE MNRLS		SAMPLE 23-24

REMARKS

BORING SB201

PAGE 1 of 2

BORING LOG	NUS CORPORATION

PROJECT: SHEPPARD AFB (SAFB) BORING NO.: SB 201
PROJECT NO.: 7$63 DATE: 11/8/88 DRILLER: G. B.
ELEVATION: 1005.49 FIELD GEOLOGIST: J. Wedekind
WATER LEVEL DATA: 17.78 BTOC
(Date, Time & Conditions) 1/17/89, SUNNY, COOL

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS / ROCK BROKENNESS	REMARKS
									HNu
					HARD	MOTTLED	CLAY SANDY, SILTY W/ OCCASIONAL		MAYBE CLAYSTONE
CORE						RDSH BRN GRNSH-	SAND STRINGERS		THAT IS HIGHLY WEATHERED
#4						GREY			
	29'		9.5/10					M	
									0 ppm
CORE									
#5					M. HARD	MOTT	CLAYSTONE, W/ SAND STRINGERS		
						RDSH-BRN	interbedded with clay		
						GRNSH GREY,	generally mottled in appearance		
	39'		10/10			YELSH BRN		M	0 ppm
				39'					

REMARKS

BORING SB 201

PAGE 2 OF 2

BORING LOG

NUS CORPORATION

PROJECT: SAFB

BORING NO.: MW 202

PROJECT NO.: 7563

DATE: 11/09/88

DRILLER: G. Pool

ELEVATION: 799.41

FIELD GEOLOGIST: J. Weddkind

WATER LEVEL DATA: 40.02 @ 1/17/89

(Date, Time & Conditions) 11/09/88 ; 1454 ; Warm, SUNNY Temp ~82°

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS/ 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS HNU
Core									
#4									Sample @ 25'
	27	10/10			M. SOFT	MOTT RDSH-BRN	CLAY, SILTY, SANDY	M	SHOL-SU-MW202 A
						GREENISH GR	BECOMES CLAYSTONE/SILTSTONE		SLIGHTLY MOIST 0ppm
							INTERBEDDED W/ SANDSTONE		ZN @ ~26'
							~~SS~~ SANDSTONE is GREENISH -		
							WHITISH GREY FINE GRAINED		
CORE #5							W/ SILTY MATRIX		
	39	10/10			M HARD	RDSH BRN	SILTSTONE, ~~WEATHERED~~	M	SLIGHTLY DAMP 0ppm
						GREENISH GR STREAKS	W/ SANDSTONE STRINGERS,		
							WEATHERED. SANDSTONE		
				41.0 SS			is fine grained to very		
Core							fine grained w/ minor		
#6							cross bedding		
					M SOFT-	RDSH BRN	SILTSTONE AS ABOVE TO		
					M HARD	(GW)	41.0 - THEN SHARP CONTACT w/	M	SEVERAL DAMP 0ppm
						LT GRNSH -GREY	SANDSTONE, VFINE - FINE		SL SOFT ZONES
	49	10/10					GRAINED, MOD WELL SORTED W/		in SANDSTONE, DAMP
							CROSS BEDS AND SILTSTONE STRINGERS.		1ppm

REMARKS LOWER ~3.0' SLIGHTLY MORE GREEN W/ SHALE "CHIPS"

BORING MW202

PAGE 2 of 3

BORING LOG NUS CORPORATION

PROJECT: SAFB BORING NO.: SB203

PROJECT NO.: 7513 DATE: 11/10/88 DRILLER: [illegible]

ELEVATION: NOT SURVEYED FIELD GEOLOGIST: J. [illegible]

WATER LEVEL DATA: DRY

(Date, Time & Conditions) 11/10/88 1119 SUNNY WARM TEMP ~105°

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS / ROCK	REMARKS
									Drilled cuttings
						DARK BROWN	TOPSOIL [illegible] SAND SILTY	SM	
	5		NA		STIFF	REDDISH BROWN	~~SILTY~~ CLAYEY w/ [illegible]		0ppm
Core #1									
	10'		0.5/5		HARD	LT. YELLOW BRN & BLACK	SANDSTONE F-MED. GRAINED w/ ABUND. OPAQUE MINERALS V. WELL CONSOLIDATED, MED. SORTED	Br	DRY 0ppm
Core #2									
									0ppm
	15'		5/5		DENSE	LT GRNSH BRN	SAND SILTY FINE GRAINED WELL SORTED, MASSIVE DRY. SILTY CLAY SEAMS BECOMES SILTY SANDY CLAY @ 15'	SM	WEATHERED SANDSTONE * COLLECTED SAMPLE SB03-SU-MW203A
Core #3									
						MOTT RDSH BRN GRNSH GR [illegible]	CLAY, SILTY [illegible] SANDY BECOMES DECOMPOSED SHALE @ 23	CL/ML	DRY 0ppm
	25'								

REMARKS

BORING SB203

PAGE 1 OF 2

BORING LOG — **NUS CORPORATION**

PROJECT: SHEPPARD AFB — BORING NO: MW204
PROJECT NO.: 7563 — DATE: 7/13/89 — DRILLER: W. CALDWELL
ELEVATION: — FIELD GEOLOGIST: J. WEDEKIND
WATER LEVEL DATA: 29.0';
(Date, Time & Conditions) 7/13/89; 1349; Cloudy Warm

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	U S C S	REMARKS HNu
							TOPSOIL and SILT CLAYEY		
							SANDY w/ ROOTS		
									DRILL to 3.0
ST-1						ORANGE BROWN	FINE TO		SHELBY TUBE 3-5
	5.0		1.0/2.0		M. HARD	MOTT GREENISH	SAND, SILTY, MEDIUM GRAINED, MODERATE - POORLY SORTED,	SM	SH02-SU-MW204A
						WHITE + BLACK	SUBROUND - SUBANGULAR MEDIUM DENSE, CONTAINS		0 ppm
							BLACK MOTTLING THROUGHOUT WEATHERED, STAINED		
	8.0								
					MEDIUM HARD	GREEN GREY	SANDSTONE, FINE GRAINED	BR	
CORE 1							MODERATELY SORTED, SUBROUND HARD, GLAUCONITIC, and		
							OPAQUE MINERALS, CROSS BEDDING WEATHERED		
									SH02-SU-MW204B
	13.0		4.3/5.0		DENSE	GREEN GREY	SAND, SILTY, FINE GRAINED MODERATELY SORTED, SUBROUND	SM	2 PHOTOS 0 ppm
							BECOMES CLAYEY (IN BANDS) at 12.8', GLAUCONITIC		
CORE #2					SOFT to	GREEN GREY,	SANDSTONE, FINE GRAINED, MODERATELY-WELL SORTED	BR	
	18.0		2.0/5.0		M. DENSE	REDDISH BROWN	SILTY, SUBROUND, ABUNDANT MOTTLING, GLAUCONITIC		1 PHOTO 0 ppm
				SS / SLTST			CROSS BEDDED, OCCASIONAL CLAY INTERBEDS, WEATHERED,		~~SH02-SU-MW~~
							RARE QUARTZ PEBBLE (~1/4")		7/13/89
CORE #3									
						MOTTLED REDDISH	SILTSTONE, SANDY, CLAYEY, MOTTLED w CONCRETIONS	M	2 photo
	23.0		5.0/5.0		MEDIUM DENSE	BROWN, GREY,	THAT RESEMBLE CHERT, MASSIVE WEATHERED		HNu malfunctioning
						YELLOW			

REMARKS

BORING MW204

PAGE 1 OF 2

BORING LOG **NUS CORPORATION**

PROJECT: SAF3 BORING NO.: MW301
PROJECT NO.: 7$63 DATE: 11/12/88 DRILLER: G. Poi
ELEVATION: 974.30 FIELD GEOLOGIST: J. Wedekind
WATER LEVEL DATA: 9.40 BTOC
(Date, Time & Conditions) 1/7/89 ... sunny, cool

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BRKS	REMARKS
									Cutting Sample
							Topsoil - SILT CLAYEY		
	5				V. STIFF	DARK RDSH	w/ OCCASIONAL ROOTS	ML	0ppm
						BRN	(FILL?)		Driller notes: 6-9' interval
									is loose clay - PROB. FILL
CORE									2ft RECOVERY
#1									~~25~~ PROBABLY REC.
	10		1/5'		V. STIFF	RDSH BRN	CLAY, SILTY w/ RARE	CL	The Bottom (ie. 9-10') 0ppm
						MOTT GRNSH GREY	"REDUCTION SPOTS"		#SH03-SU-MW301A
CORE									
#2									
	15		5/5		HARD	RDSH BROWN	CLAY SILTY w/ some	CL	0ppm
						MOTT	CONCRETIONS (?) ...		
							in size @ 13-14'		
CORE						RDSH BRN MOTT	SILT CLAYEY SL. SANDY	ML	
#3				CLAY		BLUE GRN	OCC. FISSILE, RARELY MOTTLED		
				20.5 SAND-STONE					
					M. HARD	LT. BLUE GREEN	SANDSTONE FINE GRAINED	SR	MOIST
							WELL SORTED, FINELY CROSS-		
							LAMINATED		
	25		10/10						0ppm

REMARKS

BORING MW301

PAGE ___ OF 2

BORING LOG — **NUS CORPORATION**

PROJECT: Sheppard AFB — BORING NO.: MW302

PROJECT NO.: 7363 — DATE: 11/13/88 — DRILLER: G. Pool

ELEVATION: 984.7+ — FIELD GEOLOGIST: J. Lewis

WATER LEVEL DATA: 12.19 BTOC

(Date, Time & Conditions) 11/13/88; 0838, sunny, strong southeasterly winds, high 40s.

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth,ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK	REMARKS
						Red w/	Topsoil Mixed SILT, CLAY		Cuttings sampled
						Brown	and SAND Sm glass frags.		
	5				STIFF	Red w/	SILT w/ CLAY	CL	Dry. Blk sndstn at
						Yellow-			about 8½' shows
CORE						Brown			crossbedding. HNu: 0.0ppm
#1									
				SNDSTN				BR	
	10		3/5		V. STIFF	Red w/	SILT w/ CLAY. Rare	CL	Dry. Blk sndstn layer
						Some Yellowish	granule sized concretions (?)		is ~ 2" thick.
CORE						Gray	near bottom.		SH03-3H-MW302-A collected
#2									from ~11' HNu: 0.0ppm.
				SNDSTN				BR	
	15		5/5		V. STIFF	Red w/	SILT w/ CLAY	CL	Rare granule sized
						some Gray			concretions (?). Dry.
						MTLG			HNu: 0.0 ppm.
CORE									
#3									
	25		10/10		V. STIFF	Red	SILT w/ CLAY	CL	Dry. Sl. moisture on

REMARKS

BORING MW302

PAGE 1 OF 2

BORING LOG **NUS CORPORATION**

PROJECT: SAFB BORING NO.: ~~SB402(?)~~ ~~MW401(?)~~

PROJECT NO.: 7563 DATE: 11/12/90 DRILLER: G. B-1 SB401

ELEVATION: NA* FIELD GEOLOGIST: J Weddind

WATER LEVEL DATA: DRY

(Date, Time & Conditions) 11/12/90 SUNNY COOL Temp ~ 70°

SAMPLE NO & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS/6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth,ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	MATERIAL DESCRIPTION: COLOR	MATERIAL DESCRIPTION: MATERIAL CLASSIFICATION	U S C S / ROCK BROKENNESS	REMARKS
									OBSERVED CUTTINGS
						DK BRN	Topsoil and SILT, CLAYEY		
	5				V. STIFF		w/roots, ~~[illegible]~~ crushed stone	ML	
							(FILL)		*S402-SU-MW401A
CORE #1									3 photos
	10		5/5		HARD	MOTT RDSH BRN	(9W) ~~CLAY~~ SILT CLAYEY w/ ROCK	ML	0ppm
						YELSH BRN GRAY	FRAGMENTS (sandstone) (FILL)		
							to 11.0 Then SILT CLAYEY,		
CORE #2							SLIGHTLY SANDY (NATURAL)		*S402-SU-MW401B
	15		5/5		HARD	MOTT PE[illegible]	SILT CLAYEY w/ [illegible]	ML/CL	3 photos 0ppm
						YELSH BRN	WEATHERED SHALE FRAGMENTS		
						GRAY			
CORE #3									
						MOTT			*S402-SU-MW401C
						AT [illegible]	SILT CLAYEY AS ABOVE		4 photos
	25'				HARD		EXCEPT CONTAINS NUMEROUS	ML/CL	

small < 1/4" subrounded concretions

REMARKS * NOT MEASURED

BORING MW401

PAGE 1 OF 3

BORING LOG — **NUS CORPORATION**

PROJECT: 24FB
PROJECT NO.: 7313
ELEVATION: N/A*
WATER LEVEL DATA: DRY
(Date, Time & Conditions) 11/12/88 SUNNY COOL

DATE: [illegible]
FIELD GEOLOGIST: J. Wedekind

BORING NO.: [illegible] (MW) SB401
DRILLER: [illegible]

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS/6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	U S C S / ROCK BROKENNESS	REMARKS
				— —		OLIVE			
	52		1½/2	— —	M SOFT	BRNSH GRAY	DECOMPOSED SHALE w/	M	DRY 0 ppm
							SILTY CLAY CONTAINS NUMEROUS		
							SMALL FRACTURES		

REMARKS * NOT SURVEYED

BORING MW 401

PAGE 3 OF 3

BORING LOG — **NUS CORPORATION**

PROJECT: SHEPPARD AFB — BORING NO.: MW402

PROJECT NO.: 7$63 — DATE: 11/12/88 — DRILLER: G. Pool

ELEVATION: 1003.56 — FIELD GEOLOGIST: J. Wedekind

WATER LEVEL DATA: 11.22 BTOC

(Date, Time & Conditions) 1/17/89 ; SUNNY, COOL

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
					HARD	RED-BROWN	SILT CLAYEY AS ABOVE	ML	
				27.5	HARD	MOTT GREY	SAND SILTY, CLAYEY VERY	SM	MOIST ZONE @
CORE #4						REDDISH BROWN	FINE GRAINED and SANDSTONE, FINE to VERY	SR	27.5-29.5 in SANDSTONE and in SILT above it.
				29.5			FINE GRAINED, W/ CROSS-BEDS, FRACTURES, WEATHERED		
					MEDIUM HARD	REDDISH BROWN	SILTSTONE, SANDY CLAYEY	M	
	33		7.5/8			MOTTLED GREY	SLIGHTLY FISSILE @ 32-33'		0ppm
CORE #5									
	41		8/8		HARD	MOTTLED DARK BRNISH GREY REDDISH BROWN	SILTSTONE, WEATHERED, WITH NUMEROUS CLAY-FILLED FRACTURES	M	DRY 0ppm

REMARKS

BORING MW402

PAGE 2 OF 2

BORING LOG | NUS CORPORATION

PROJECT: SHEPPARD AFB | BORING NO.: SB403
PROJECT NO.: 7$63 | DATE: 12/12/88 | DRILLER: G. Pool
ELEVATION: 1005.58 | FIELD GEOLOGIST J. WEDEKIND, P. POGUE
WATER LEVEL DATA: 19.85
(Date, Time & Conditions) 1/17/89; SUNNY, COOL

SAMPLE NO. & TYPE OR RQD	DEPTH (Ft.) OR RUN NO.	BLOWS/6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth,ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS
									HNu
CORE #4									
									ROUGH DRILLING
					MOD. HARD - MOD SOFT	REDDISH BROWN MOTT GREENISH	SILTSTONE, SHALEY, OCCASIONALLY SANDY W/ CROSS BEDDING AND SOME FISSILITY, WEATHERED	M	DRY - DAMP 0ppm
	35		9/10						
CORE #5									
	45		10/10		MOD. SOFT	MOTT GREYISH BROWN	SILTSTONE, SHALEY, DEEPLY WEATHERED, BREAKS HACKLY	M	DRY 0ppm
C-2	50		NA		MODERATELY HARD	GREYISH BROWN	SHALE AND SILTSTONE, AS ABOVE		DRY 0ppm

REMARKS

BORING SB 403

PAGE 2 OF 3

BORING LOG **NUS CORPORATION**

PROJECT: SHEPPARD AFB BORING NO.: MW501
PROJECT NO.: 7363 DATE: 12/08/88 DRILLER: G. Pool - W. CALDWELL
ELEVATION: 1007.88 FIELD GEOLOGIST: P. POGUE / J. WEDEKIND
WATER LEVEL DATA: 6.61 BTOC
(Date, Time & Conditions) VERY COLD, WINDY, SNOW TEMP ~ 20°, 12/08/88

SAMPLE NO. & TYPE OR ROD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS HNu
	2		NA		LOOSE	BROWN	TOPSOIL and SAND, SILTY CLAYEY W/ ABUNDANT ROOTS	SM	0 ppm
ST-1	4		1.6/2		LOOSE	LIGHT BROWN MOTTLED GREY	SAND, SILTY, CLAYEY, FINE GRAINED WELL SORTED (FILL?)	SM	SHO5-SU-SB501A 0 ppm AIR DRILL 4.5'
CORE #1				SAND FILL					
				SAND-STONE?			NO RECOVERY		W. CALDWELL REPORTS BOTTOM FILL @ ~8.0'
	10		0/5		VERY LOOSE	LIGHT BROWN?	PROBABLY LOOSE SAND FILL		
CORE #2									
	15		2.5/5.0		HARD	LIGHT BROWN-BLACK	SANDSTONE, ABUNDANT ORGANICS AND	BR	11 ppm*
					LOOSE	YELLOWISH BROWN	SAND, SILTY, CLAYEY, FINE GRAINED MODERATELY SORTED	SM	DAMP SHO5-SU-SB501B
					HARD	YELLOW-LT. GREY	SANDSTONE, W/ OCC CLAY "NODULES" SLIGHTLY LAMINATED	BR	HIGH ORGANIC CONTENT IN UPPER 6'
CORE #3				SANDST. / CLAY					SHO5-SU-SB501C
					HARD	REDDISH BROWN	CLAY, MOTTLED GREY & GREEN	CH	
	20								
	25		10/10		HARD	GREY-REDDISH BROWN	CLAY, SHALEY, MOTTLED, BECOMES MORE RED-BROWN @ BASE	CH	11 ppm*

REMARKS * HNu probably malfunctioning - see log book.

BORING MW501

PAGE 1 of 2

BORING LOG — **NUS CORPORATION**

PROJECT: SHEPPARD AFB — BORING NO.: MW 502
PROJECT NO.: 7563 — DATE: 12-03-88 — DRILLER: W. Caldwell
ELEVATION: 1004.74 — FIELD GEOLOGIST: J. Wedekind / P. Pogue
WATER LEVEL DATA: 7.04 BTOC
(Date, Time & Conditions) 1/17/89; SUNNY, COOL

SAMPLE NO. & TYPE OR RQD	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
									HNu
						REDDISH BROWN	TOPSOIL and Sand Elev...	SM	
ST-1	3.0		1.4/2		M. DENSE - LOOSE	YELLOW BROWN	SAND, CLAYEY, FINE GRAINED MODERATELY SORTED		SH05-SU-MW502A
									0 ppm
CORE #1				NR			Probably loose sand and handfill ?		NO RECOVERY
	10.0		0/5						
CORE #3				NR			Probably loose sand and handfill ?		NO RECOVERY
	15.0		0/5						
ST-2			0.5/2*		HARD	LIGHT BROWN W/BLACK GRAINS	SAND, SILTY, CLAYEY, FINE GRAINED MODERATELY SORTED W/ OCCASIONAL CLAY NODULES and RUBBLE, DAMP		SH05-SU-MW502B 0 ppm
					MEDIUM SOFT	LIGHT BROWN	SANDSTONE, FINE GRAINED, WELL - MODERATELY SORTED	SR	MOIST
CORE #4						MOTT. BLACK	W/ CROSS-BEDDING		SH05-SU-MW502C
					HARD	MOTTLED DARK BROWN REDDISH GREY & BLACK	CLAY SILTY MOTTLED W/ WEATHERED SHALE	ML CL	DRY
									0 ppm
	25								

REMARKS * Bent Tube

BORING SB502

PAGE 1 OF 2

BORING LOG | **NUS CORPORATION**

PROJECT: SAFB | BORING NO.: MW 503
PROJECT NO.: 7$63 | DATE: 12-09-88 | DRILLER: W. CALDWELL
ELEVATION: 1000.02 | FIELD GEOLOGIST: J. Wedekind, P. Pague
WATER LEVEL DATA: 8.29' BToc
(Date, Time & Conditions) 1/17/89; SUNNY, COOL

SAMPLE NO. & TYPE OR ROD	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENESS	REMARKS UNu
ST-1	2		1.5/2		HARD	RDSH BROW	SAND, SILTY, CLAYEY, w/ROOTS VERY FINE GRAINED	SM	DRY $HOS-$U-MW503A
	- -								Open
	8				LOOSE	YELLOW BROW	SAND SILTY, CLAYEY, FINE to VERY FINE GRAINED, MOD. SORTED	SM	OBSERVED CUTTINGS
ST-2	7		1/2		MEDIUM DENSE	LIGHT YELLOW-BROWN	SAND, AS ABOVE	SM/SC	$HOS-$U-MW503B
									Open
CORE #1			~~3/3~~						$HOS-$U-MW-503C
					LOOSE - M. DENSE		SAND, SILTY, CLAYEY, FINE GRAINED, WELL-MODERATELY	SM/SC	MOIST
	12		3/5			YELLOW BROWN w/BLACK	SORTED WITH SANDSTONE, FINE GRAINED, WELL-MEDIUM		Open
					MEDIUM HARD		SORTED w/ CROSS BEDS and BLACK ORGANIC(?) GRAINS		
CORE									
#2						MOTTLED LIGHT			
	17		2.5/5.0		VERY STIFF	GREYISH YELLOW	SAND, CLAYEY, SILTY ~~FINE~~ to VERY FINE GRAINED MODERATELY	SC/SM	MOIST Open
				SAND		BROWN	SORTED, GRADING to SILTY CLAY.		
				CLAY					
CORE									
#3									

REMARKS

BORING MW503

PAGE 1 of 2

BORING LOG **NUS CORPORATION**

PROJECT: JAFB
PROJECT NO.: I$63
ELEVATION: NA**
WATER LEVEL DATA: 49.0' *
(Date, Time & Conditions) [illegible] WINDY [illegible]

BORING NO.: ~~[illegible]~~ SB601
DATE: [illegible]
DRILLER: [illegible]
FIELD GEOLOGIST: [illegible]

SAMPLE NO. & TYPE OR ROD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth,ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	U S C S	REMARKS
									[illegible]
									CUTTINGS
					V. STIFF	DK. RDSH	[illegible] SILT CLAYEY	ML	SAMPLE
						BRN	w/ [illegible]		
	5		5'/~						Open
Core									
#1									
	10'		5'/~		HARD	RDSH BRN	SILT CLAYEY with	ML/CL	Open
							OCCASIONAL SHALE CHIPS		SA06-SU-MW601A (9W [illegible])
Core #2									
	15		5'/~		HARD	RDSH [illegible]	CLAY SILTY with [illegible]	CL	Open
						MOTT BLUISH	[illegible]		
						GREY			
						YELL BRN			
Core									
#3									
					HARD	RDSH BRN	CLAY SILTY with [illegible]	CL	
						MOTT [illegible]	DECOMPOSED SHALE [illegible]		
	25		10'/~						Open

REMARKS * PROBABLY DRILL WATER
** NOT MEASURED

BORING SB601

PAGE 1 OF 2

BORING LOG

NUS CORPORATION

PROJECT: SAFB
BORING NO: SB701
PROJECT NO.: 7763
DATE: 12/07/88
DRILLER: W. Caldwell
ELEVATION: 992.71
FIELD GEOLOGIST: J. Wedekind, P. Pogue
WATER LEVEL DATA: 11.33 BTOC
(Date, Time & Conditions) 1/17/89 ; CLEAR, COOL

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS HNu
ST-1	2.0		1/2		V. STIFF	DARK RDSH BROWN	SILT, CLAYEY, SANDY WITH TRACE GRAVEL, ROOTS	ML	0ppm
ST-2	4.0		1.0/2		HARD	DARK RDSH BROWN	SAND, SILTY, CLAYEY WITH ROOTS and GRAVEL (CRUSHED STONE)	SM/ML	DRY 0ppm
									SHO7-SU-SB701A
CORE #1									
	~~9.0~~ 10.0		2.0/5.0		FIRM	RDSH BROWN OCC LIGHT BROWN	SAND, SILTY CLAYEY FINE GRAINED, WELL SORTED, SOME SANDSTONE, WEATHERED	SM	DAMP 0ppm
CORE #2									SHO7-SU-SB701B
	15		4.0/5.0		STIFF-FIRM	RDSH BROWN MOTT LIGHT BROWN GREYISH	SAND, SILTY, CLAYEY, FINE-VFINE GRAINED, MEDIUM SORTED RELICT HORIZONTAL BEDDING	SM/ML	DAMP 7 ~~0ppm~~ 8
				SS					SHO7-SU-SB701C
				SILT		MOTT RDSH BRN GRNSH	SILT, CLAYEY, SANDY, MOTTLED	ML/SM	
CORE #3				SS	M. SOFT	LIGHT BROWN WITH BLACK GRAINS	SANDSTONE, FINE - VERY FINE GRAINED ~~was~~ MEDIUM-WELL SORTED, MASSIVE	BR	
	25		6.0/10.0						MOIST

REMARKS

BORING SB701

PAGE 1 OF 2

BORING LOG — NUS CORPORATION

PROJECT: SHEPPARD AFB
BORING NO.: MW702
PROJECT NO.: 7863
DATE: 12/07/88
DRILLER: W. Caldwell
ELEVATION: 991.79
FIELD GEOLOGIST: J. Wedekind
WATER LEVEL DATA: 11.07 3TOC
(Date, Time & Conditions) 1/12/89 ; clear cool

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BRK	REMARKS HNu
							TOPSOIL AND SILT CLAYEY W/ CRUSHED STONE (PROB. FILL)		
S-1	5		NA		NA	REDDISH BROWN	SAND, SILTY, CLAYEY	SM	CUTTINGS SAMPLE 0 ppm
CORE #1			1.5/5						
							SAND VERY SILTY CLAYEY, VERY FINE TO FINE GRAINED	SM	POOR SAMPLE RECOVERY
	10				SOFT - HARD	REDDISH BROWN	MODERATELY SORTED W/ SANDSTONE FINE GRAINED WEATHERED	BR	SH702-SU-MW702A 0 ppm
CORE #2									
	15		1.1/5		SOFT - HARD	ROSY BROWN - YELLOW	SANDSTONE, FINE GRAINED WELL SORTED WEATHERED	BR	POOR RECOVERY 0 ppm
CORE #3									
					MEDIUM HARD	YELLOW GREENISH BROWN	SANDSTONE, FINE GRAINED WELL SORTED, W/ CROSS BEDS, ABUNDANT ORGANIC(?) OPAQUES BECOMES VERY CLAYEY @ 24' - POSSIBLY GLAUCONITIC	BR	0 ppm
				23 CLAYEY SAND					
	25		5/10						SH07-SU-MW702B

REMARKS

BORING MW702

PAGE 1 OF 2

BORING LOG — **NUS CORPORATION**

PROJECT: SAFB
BORING NO.: SB801
PROJECT NO.: 7863
DATE: 12/06/88
DRILLER: W. Caldwell
ELEVATION: 986.91
FIELD GEOLOGIST: J. Wedekind
WATER LEVEL DATA: 9.93
(Date, Time & Conditions) 1/17/89 ; CLEAR, COOL

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS (MATERIAL DESCRIPTION)	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS HNu
						BROWN	TOPSOIL ~~BR~~ SILTY SAND		
							w/ ROOTS		CAUGHT 0-5
									CUTTINGS
	5		NA		SOFT	DARK BROWN	SAND, SILTY FINE GRAINED w/ OCC. COARSER GRAINED SAND	SM	FUEL ODOR 40ppm
									SH08-SU-SB801A
CORE							SANDSTONE FINE GRAINED WELL SORTED and		
#1						LT BRN and	SAND SILTY FINE to MEDIUM	SM	MOIST
	10		1.5/5		FIRM	BLUISH-GREY	GRAINED MEDIUM SORTING CRUDELY BEDDED		1.0ppm
							except CLAYEY		
						LT BRN	SAND AS ABOVE to 12.0 ft	SM	0ppm
CORE #2				12.0					
	15		3.5/5.0		HARD	RDSH BRN w/ BLUISH GREY	CLAY, SILTY, OCCASIONALLY SANDY.	ML/CL	DRY 1.0ppm
									SH08-SU-SB801B
CORE									
#3									
					HARD	RDSH BROWN	CLAY SILTY OCCASIONALLY SANDY WITH RELICT	ML/CL	DRY
							BEDDING SOMEWHAT FISSILE, TO WEATHERED SHALE		
	25		10/10						0ppm

REMARKS * PLASTIC BAG SAMPLE
SAMPLE SH08-SU-SB801A collected due to fuel odor

BORING SB801

PAGE 1 OF 2

BORING LOG — **NUS CORPORATION**

PROJECT: SHEPPARD AFB — BORING NO.: MW802
PROJECT NO.: 7563 — DATE: 7/13/89 — DRILLER: W. Caldwell
ELEVATION: — FIELD GEOLOGIST: J. Wedekind
WATER LEVEL DATA: 9.5'
(Date, Time & Conditions) 7/14/89; 0711, CLOUDY, WARM

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK	REMARKS HNU
							Topsoil and SILT CLAYEY		
ST-1	5.0		1.0/2.0		STIFF	REDDISH BROWN	SILT, CLAYEY, OCCASIONALLY SANDY w/ TAR, CRUSHED STONE ROOTS (FILL)	ML	SHOB-SU-MW802A Oppm
				FILL			W/CS (FILL)		BOTTOM OF FILL ~8.5'
ST-2	10		1.0/2.0	SAND	SOFT	BROWN GREENISH GREY	SILT, CLAYEY/WET, BECOMES SAND, SILTY, FINE GRAINED MODERATELY SORTED, SUBROUNDED w/ BLACK GRAINS	SM	SHOB-SU-MW802B Oppm
CORE #1									
	15		1.0/5.0		MEDIUM HARD	GREEN GREY	SANDSTONE SLIGHTLY SILTY FINE GRAINED MODERATELY SORTED SUBROUND, BLACK ALTERATION COMMON, CLAY SEAM @ TOP THINBEDDED	BR	POOR RECOVERY Oppm
					MEDIUM HARD &	GREEN GREY	SANDSTONE, FINE GRAINED	BR	Oppm
CORE #2				ST	MEDIUM SOFT		SILT MATRIX, MODERATELY SORTED SUBROUND, SOME SOFTENED ZONES, GRADES TO SILTSTONE, @ 20-21'		SHOB-SU-MW802C 4 photos
				SH	MEDIUM SOFT	REDDISH BROWN MOTT GREY	SILTSTONE CLAYEY, MOTTLED, WEATHERED	M	
	25		10/10						Oppm

REMARKS

BORING MW802

PAGE 1 OF 2

BORING LOG NUS CORPORATION

PROJECT: SHEPPARD AFB BORING NO.: MW803
PROJECT NO.: 7563 DATE: 7/14/89 DRILLER: W. Caldwell
ELEVATION: FIELD GEOLOGIST: J. WEDEKIND
WATER LEVEL DATA: 8.10'
(Date, Time & Conditions) 7/15/89; 0850; FOGGY, HUMID, WARM

SAMPLE NO. & TYPE OR ROD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS HNu
						BROWN	SILT, CLAYEY, SANDY w/	ML	
							ROOTS		
ST-1	5.0		1.5/2.0		MED. SOFT	DARK	SILT, CLAYEY, SANDY, w/	ML	SHO8-SU-MW803A 0ppm
						BROWN	OCCASIONAL ROOTS & CRUSHED		MOIST
							STONE, TOPSOIL		
									DRILLER NOTES SLIGHT
									"FUEL" ODOR
ST-2	10.0		1.0/2.0		LOOSE	BLUISH GREEN	SAND, SILTY, SLIGHTLY CLAYEY, FINE GRAINED, SUBROUND,	SM	SHO8-SU-MW803B
							MODERATELY SORTED, GLAUCONITIC?		MOIST 0ppm
				SAND			SAND AS ABOVE to 11.5'		SAMPLE HAS SLIGHT
CORE #1				CLAY			EXCEPT THIN BEDDED		ODOR OF WEATHERED FUEL
						MOTT			SHO8-SU-MW803C
	15.0		2.0/2.0		MODERATE HARD	RED-BROWN	SILTSTONE, CLAYEY NODULES, WEATHERED	M	@ 11.5' 0ppm
						& GREY			
CORE #2									
						MOTT			
					MODERATE HARD	RED-BROWN	SILTSTONE, CLAYEY, BIOTURBATED WEATHERED		0ppm
	25.0		10/10			and GREY		M	

REMARKS

BORING MW803

PAGE 1 OF 1

BORING LOG

NUS CORPORATION

PROJECT: SHEPPARD AFB BORING NO.: SB11-1
PROJECT NO.: 7513 DATE: 12/11/88 DRILLER: W. CALDWELL
ELEVATION: 1003.73 FIELD GEOLOGIST: P. Page, J. Wedekind
WATER LEVEL DATA: 10.81' BTOC
(Date, Time & Conditions) 1/17/89 CLEAR COOL

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS/ 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	U S C S / ROCK BORING	REMARKS HNu
									MOIST ZN @ @-28.5
CORE #4							CLAY AND SILT AS ABOVE w/ WEATHERED SHALE		
						BROWN			
	35		6.5/10	MONITORED INTERVAL	SOFT	BROWN MOTT GREENISH	SHALE, AND SILTSTONE WEATHERED SOME FISSILITY AND ORIGINAL LAMINATION IN AREAS.	M	DRY 0ppm
				WEA SILTST					
					MEDIUM SOFT	BROWNISH GREY	WEATHERED SHALE AND SILTSTONE, FISSILE	M	
CORE #5									
	45		9/10		MEDIUM SOFT	REDDISH BROWN	SHALE AND SILTSTONE, WEATHERED	M	DRY 0ppm
					MEDIUM HARD				
									AIR DRILLED
					MEDIUM SOFT	BROWN-GREY	WEATHERED SHALE, SILTY BREAKS HACKLY	M	TO 60' - COLLECTED
									CUTTINGS

REMARKS

BORING SB11-1

PAGE 2 OF 3

BORING LOG — **NUS CORPORATION**

PROJECT: $AFB — BORING NO.: BB01
PROJECT NO.: 7$63 — DATE: 12-07-88 — DRILLER: W. Caldwell
ELEVATION: 1003.82 — FIELD GEOLOGIST: J. Wedekind, P. Pogue
WATER LEVEL DATA: NA
(Date, Time & Conditions) 12-07-88, 1543, Overcast, cold, windy

SAMPLE NO. & TYPE OR RQD	DEPTH (FT.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH *	LITHOLOGY CHANGE (Depth/ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCKS	REMARKS
						Dk. Brn	Topsoil		
					Stiff	Rdsh Brown	Silt, clayey, sandy	ML	Observed cuttings
ST-1	7				HArd	Light Brown	Sand, silty, very fine - fine grained, med. sorting	SM	SH12-SU-BB01A
						Light Brown	sand, silty, clayey, fine grained, med sorting - grades to sandstone	SM	
ST-2	17								SH12-SU-BB01B
	19					Dark Brown	Sand, clayey, fine grained, med. sorting	SC	
	21						Water Encountered Thin clay streak, then back to clayey sand		Water encountered

REMARKS: * Observed cuttings

BORING BB01

PAGE 1 of 2

BORING LOG NUS CORPORATION

PROJECT: SHEPPARD AFB BORING NO.: MW 13-1

PROJECT NO.: 7563 DATE: 7/15/89 DRILLER: W. CALDWELL

ELEVATION: FIELD GEOLOGIST: J. WEDEKIND

WATER LEVEL DATA: 11.4' Below Top of Ground

(Date, Time & Conditions) 7/15/89 ; 1713 ; HOT, SUNNY

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS/ 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCKS	REMARKS HNU (PPM) SCAN/HEAD-SPACE
							SAND, SILTY, CLAYEY w/ ROOTS		
					HARD	MOTTLED REDDISH	SAND, SILTY, CLAYEY, MEDIUM	SM	SANDSTONE ROCK
ST-1	5.0		0.5/2.0			YELLOW-BROWN	-FINE GRAINED, POORLY SORTED, WITH ROCK FRAGMENTS (FILL)		FRAGMENTS APPEAR TO BE FILL 0/0
				FILL			FILL AS ABOVE TO 9.0 THEN		
[illegible]-2	10.0		1.5/2.0		VERY STIFF	MOTTLED REDDISH YELLOW BROWN, DARK BROWN	SAND, SILTY, CLAYEY, FINE GRAINED w/ ROOTS	SM/ML	MOIST 0/0
CORE #1									NO RECOVERY FROM
							APPARENTLY LOOSE SAND		CORE - PUSHED SHELBY
	15.0		0.0/5.0				- NO RECOVERY -		TUBE 15-17'
						REDDISH BROWN			SHO3-SU-SB13-4
ST-3	17.0		1.5/2.0		MEDIUM DENSE	MOTTLED LIGHT BROWN	SAND, CLAYEY, SILTY, FINE GRAINED, MODERATELY SORTED, SUBROUND, PLASTIC	SC	WATER ENCOUNTERED @ 15' as PER DRILLER
									MOIST 0/0
CORE #2					SOFT	REDDISH BROWN	SAND, CLAYEY AS ABOVE		WET
	23.0		5.0/6.0		MEDIUM SOFT	LIGHT GREENISH GREY MOTTLED BLACK	SANDSTONE, SILTY, FINE GRAINED, MODERATELY SORTED, SUBROUND, THIN BEDDED, GLAUCONITIC(?)	M	2 PHOTOS 0/0

REMARKS

BORING SB 13-1

PAGE 1 OF 2

BORING LOG NUS CORPORATION

PROJECT: SHEPPARD AFB BORING NO.: MW13-2

PROJECT NO.: 7863 DATE: 7/15/89 DRILLER: W. CALDWELL

ELEVATION: FIELD GEOLOGIST: J. WEDEKIND

WATER LEVEL DATA: 12.6'

(Date, Time & Conditions) 7/15/89; 1740; SUNNY, HOT

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS/ 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK	REMARKS	HNU (PPM) SCAN	HNU (PPM) HEAD SPACE
							SAND SILTY W/ ROOTS				
ST-1	5.0		1.0/2.0		HARD	BROWN MOTTLED YELLOWISH BROWN	SILT, SANDY CLAYEY W/ CRUSHED STONE (FILL)	SM/ML		0	0
ST-2	10.0		1.0/2.0		HARD-VERY STIFF	DARK BROWN MOTTLED YELLOW BROWN	SILT, SANDY CLAYEY PROBABLY NATURAL SOIL	SM/ML	SH13-SU-MW13-2A MOIST	0	0
CORE #1							VERY POOR RECOVERY - PROBABLY LOOSE SAND -				
	15.0		0.5/5.0		LOOSE	REDDISH BROWN	SAND, CLAYEY, SILTY, FINE GRAINED, MODERATELY SORTED, SUBROUND	SC	DRY	0	0
CORE #2											
					SOFT	REDDISH BROWN	SAND, CLAYEY, FINE-MEDIUM GRAINED, MODERATE - POORLY SORTED, SUBROUND W/ PEBBLES ½-¾" diameter MOSTLY @ CONTACT	SC	MOIST/WET		
	25.0		3.0/10.0		HARD	REDDISH BROWN	CLAY SILTY GRADES TO WEATHERED SILTSTONE	CL/ML		0	0

REMARKS: WATER ENCOUNTERED @ ~ 21'. MOIST ZONE IN SAND WITH PEBBLES

BORING MW13-2

PAGE 1 OF 2

BORING LOG — **NUS CORPORATION**

PROJECT: SHEPPARD AFB — BORING NO.: SB-13-3
PROJECT NO.: 7563 — DATE: 7/15/89 — DRILLER: W. CALDWELL
ELEVATION: — FIELD GEOLOGIST: J. WEDEKIND
WATER LEVEL DATA: 12.94' BELOW TOP OF CASING
(Date, Time & Conditions) 7/20/89 ; 0915 ; SUNNY, WARM

SAMPLE NO. & TYPE OR ROD	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth/ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	U.S.C.S. OR ROCK	REMARKS	HNu ppm SCAN / HEADSPACE
							TOPSOIL and SILT w/ ROOTS			
ST-1	5.0		1.0/2.0		STIFF	MOTTLED YELLOW-REDDISH BROWN, BLACK	SAND, SILTY, CLAYEY, FINE GRAINED w/ CINDERS, WEATHERED ROCK FRAGMENTS (FILL)	SM		0/0
ST-2	10.0		1.7/2.0		VERY STIFF	MOTTLED YELLOW, REDDISH BROWN BLACK	SAND, CLAYEY, SILTY, WITH ROCK FRAGMENTS, CINDERS (FILL)	SM	SLIGHTLY MOIST	0/0
CORE #1									SH13-SU-SB13-3A	
	15.0		2.8/5.0		VERY STIFF	MOTTLED GREYISH GREEN, YELLOW GREY	SAND, SILTY, CLAYEY, FINE GRAINED, MODERATELY SORTED, SUBROUND WITH CLAYEY MATRIX	SM	1 PHOTOGRAPH MOIST	0/0
					HARD	REDDISH BROWN	CLAY, SILTY, SANDY	CL		
					MODERATELY HARD	LIGHT BROWN	SANDSTONE, FINE GRAINED, MODERATELY SORTED, SUBROUND w/ RARE PEBBLES (<½")	BR	MOIST	
CORE #2										
	25.0		3.6/10.0		VERY STIFF	DARK REDDISH BROWN	CLAY AND SILTSTONE, CLAYEY DEEPLY WEATHERED, BIOTURBATED, MASSIVE	CL	1 PHOTOGRAPH	0/0

REMARKS

BORING SB-13-3

PAGE 1 OF 2

BORING LOG — **NUS CORPORATION**

PROJECT: SHEPPARD AFB — BORING NO.: MW13-4
PROJECT NO.: 7$63 — DATE: 7/16/89 — DRILLER: W. CALDWELL
ELEVATION: — FIELD GEOLOGIST: J. WEDEKIND
WATER LEVEL DATA: 13.36 BTOG
(Date, Time & Conditions) 7/20/89 ; 0915 ; SUNNY, WARM

SAMPLE NO. & TYPE OR RQD	DEPTH (ft.) OR RUN NO.	BLOWS/ 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth.ft.) OR SCREENED INTERVAL	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BREAKS	REMARKS	HNu (ppm) SCAN / HEAD-SPACE
						LIGHT REDDISH-BROWN-DARK BROWN	SAND, SILTY, CLAYEY, and TOPSOIL w/ ROOTS			
ST-1	7.0		1.0/2.0		HARD	MOTTLED BROWN, YELLOW REDDISH BROWN, BLACK	SAND, CLAYEY, SILTY FINE GRAINED WITH CINDERS WEATHERED ROCK FRAGMENTS (FILL)	SC	DRY	0/0
ST-2	12.0		1.0/2.0		HARD	MOTTLED REDDISH BROWN, BLACK YELLOW	SAND, SILTY, CLAYEY, AS ABOVE (FILL)	SC	DRY	0/1.0
ST-3	17.0		1.5/2.0		SOFT	REDDISH BROWN AND BROWN	SAND, CLAYEY SILTY FINE GRAINED, MODERATELY SORTED SUBROUND	SC	SH13-SU-MW13-4A WET TO MOIST	0/0
ST-4	22.0		1.7/2.0		SOFT	REDDISH BROWN	SAND, AS ABOVE	SC	WET	0/0

REMARKS: WATER ENCOUNTERED @ 15' as per DRILLER

BORING MW 13-4

PAGE 1 OF 2

B

APPENDIX B

WELL COMPLETION FORMS

[redacted]

APPENDIX B

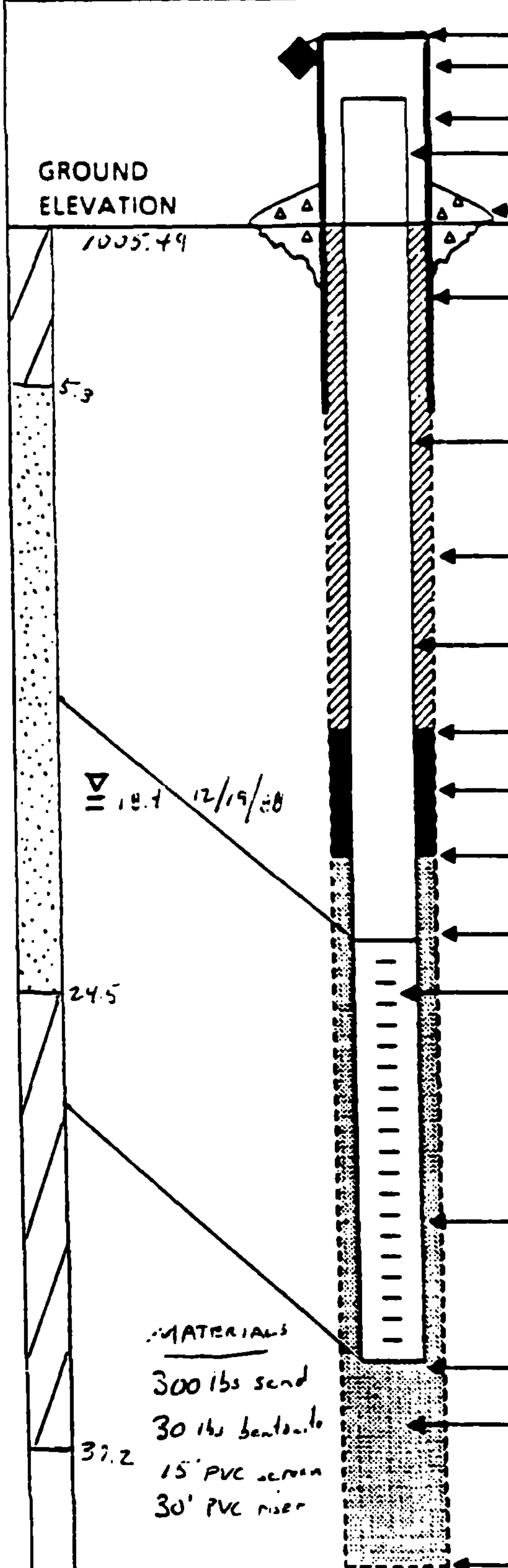
WELL COMPLETION FORMS

BORING NO.: MW201

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB	LOCATION: WICHITA FALLS, TX	DRILLER: G. Pe[illegible]
PROJECT NO.: 7563	BORING: MW201	DRILLING METHOD: AIR ROTARY
ELEVATION: 1005.49	DATE: 11/10/88	DEVELOPMENT METHOD: AIR LIFT/BAILING
FIELD GEOLOGIST: J. WEDEKIND		



MATERIALS
300 lbs sand
30 lbs bentonite
15' PVC screen
30' PVC riser

ELEVATION OF TOP OF SURFACE CASING: 1008.16
ELEVATION OF TOP OF RISER PIPE: 1008.04
STICK - UP TOP OF SURFACE CASING: 2.67
STICK - UP RISER PIPE: 2.55
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL x 5'
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 8.0
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 11.0
ELEVATION / DEPTH TOP OF SCREEN: 13.0
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010" x 15'
I.D. OF SCREEN: 2" x 10'
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 28.0
ELEVATION / DEPTH BOTTOM OF SAND PACK: 31.6
TYPE OF BACKFILL BELOW OBSERVATION WELL: Bentonite Pellets
ELEVATION / DEPTH OF HOLE: 37.2

NUS CORPORATION
A Halliburton Company

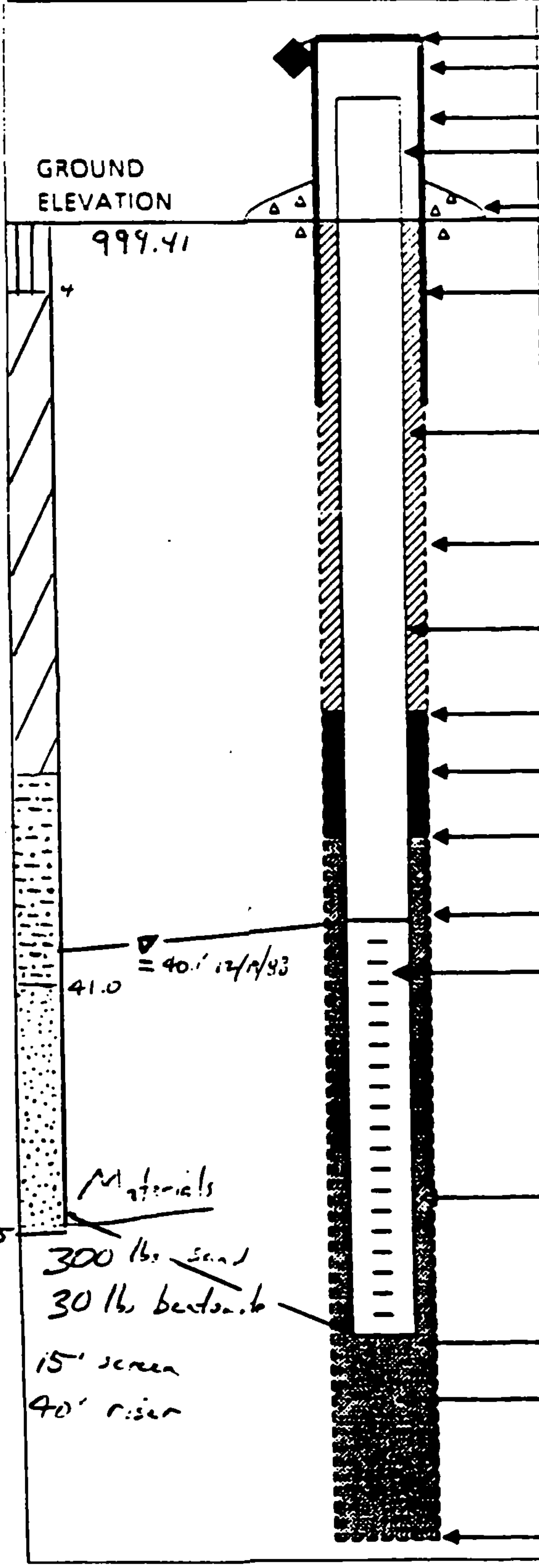
BORING NO. MW 102

MONITORING WELL SHEET

PROJECT SAFB
PROJECT NO. 7563
ELEVATION 999.41
FIELD GEOLOGIST J. Wedeland

LOCATION Wichita Falls TX
BORING MW 402
DATE 11/11/88

DRILLER G. Paul
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift/Bailing



ELEVATION OF TOP OF SURFACE CASING: 1002.04
ELEVATION OF TOP OF RISER PIPE: 1001.87
STICK - UP TOP OF SURFACE CASING: 2.63
STICK - UP RISER PIPE: 2.46
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL x 5'
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 34.0
TYPE OF SEAL: Bentonite Pellets (1/4")
DEPTH TOP OF SAND PACK: 37.0
ELEVATION / DEPTH TOP OF SCREEN: 39.0
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE x LENGTH: 0.010" x 15'
I.D. OF SCREEN: 2" x 10'
TYPE OF SAND PACK: 20-40 Silica Sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 54.0
ELEVATION / DEPTH BOTTOM OF SAND PACK: 54.6
TYPE OF BACKFILL BELOW OBSERVATION WELL: SAND
ELEVATION / DEPTH OF HOLE: 54.6

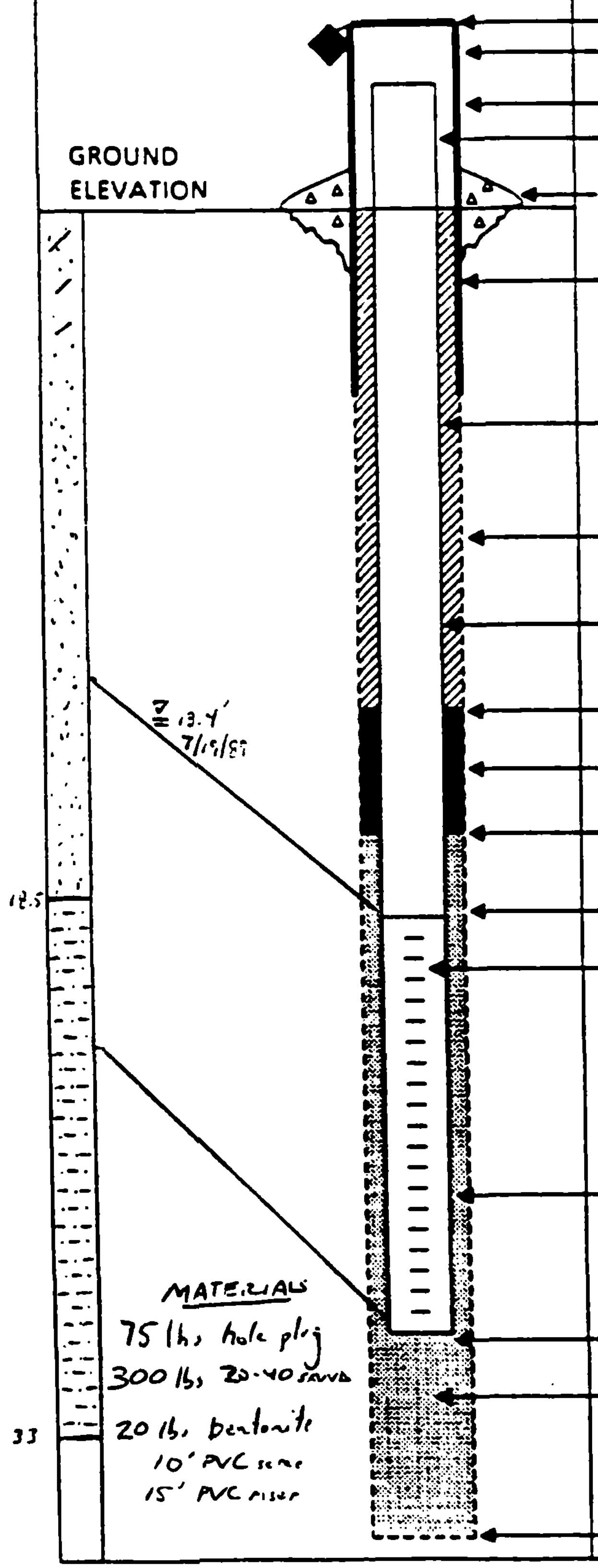
BORING NO.: MW204

NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
LOCATION: Wichita Falls Tx
PROJECT NO. 7863
BORING: MW-204
ELEVATION:
DATE: 7/4/89
FIELD GEOLOGIST: J WEDEKIND

DRILLER: W. Caldwell
DRILLING METHOD: Air Rotary
DEVELOPMENT METHOD: Air Lift/Bailing



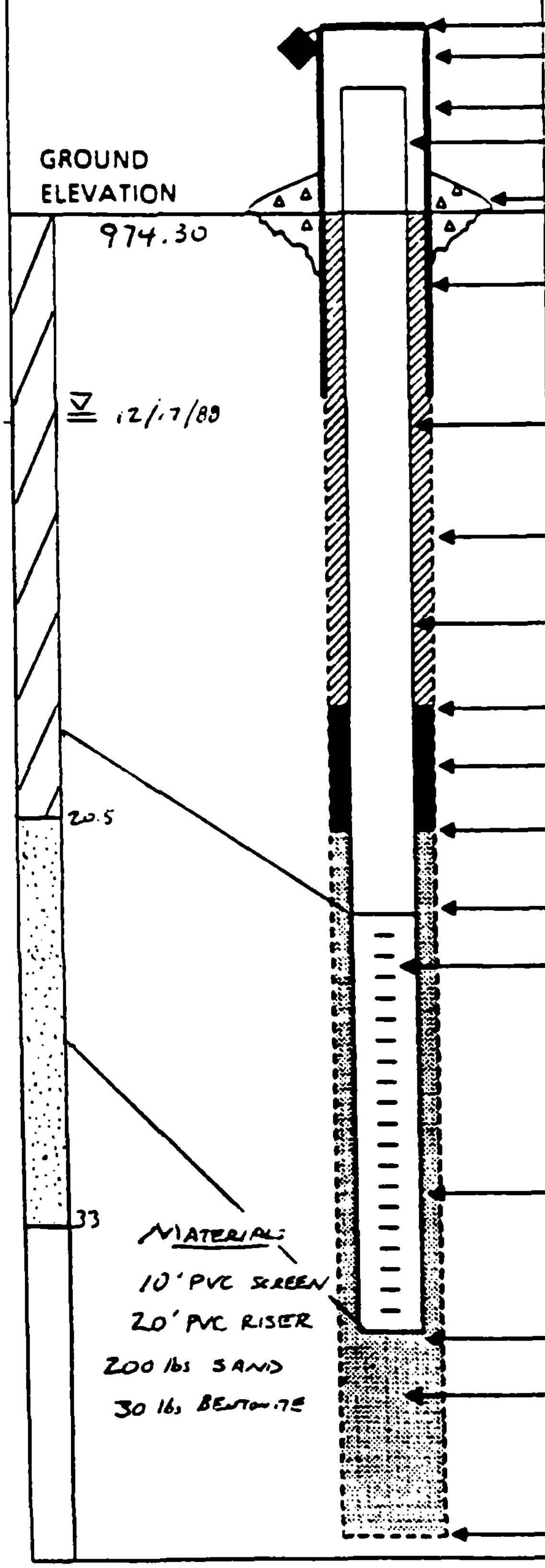
ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING: 2.58
STICK-UP RISER PIPE: 2.35
TYPE OF SURFACE SEAL: CONCRETE PAD 3×3'
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: GALVANIZED STEEL ×5'
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 9.0
TYPE OF SEAL: Bentonite Pellets (1/4")
DEPTH TOP OF SAND PACK: 11.0
ELEVATION / DEPTH TOP OF SEAL SCREEN: 12.6'
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010" × 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA
ELEVATION / DEPTH BOTTOM OF SCREEN: 22.6'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 25'
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG
ELEVATION / DEPTH OF HOLE: 33'

BORING NO: MW301

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB	LOCATION: WICHITA FALLS TX
PROJECT NO.: 7563	BORING: MW 301
ELEVATION: 974.30	DATE: 11/13/88
FIELD GEOLOGIST: J. WEDEKIND	

DRILLER: G. POOL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT



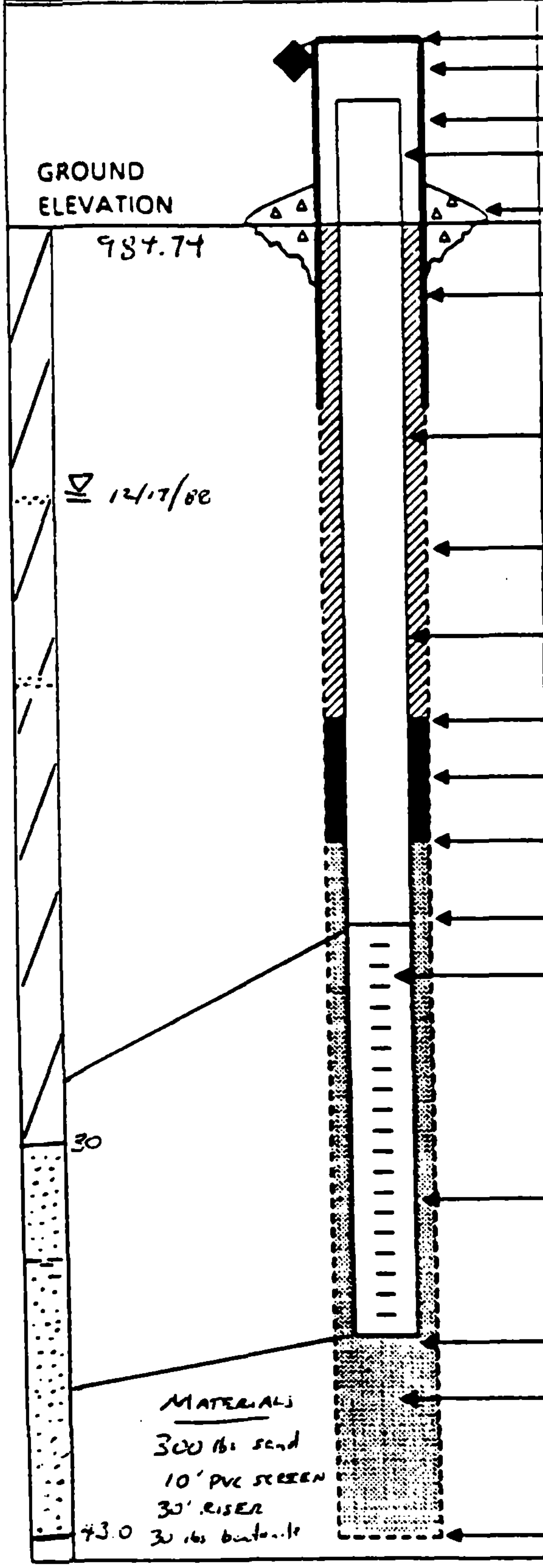
ELEVATION OF TOP OF SURFACE CASING: 976.48
ELEVATION OF TOP OF RISER PIPE: 976.34
STICK-UP TOP OF SURFACE CASING: 2.18
STICK-UP RISER PIPE: 2.04
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL x 5'
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 12'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 15'
ELEVATION / DEPTH TOP OF SCREEN: 17'
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010 x 10'
I.D. OF SCREEN: 2" x 10'
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 27'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 28'
TYPE OF BACKFILL BELOW OBSERVATION WELL: BOREHOLE CAVED TO 28' - NATURAL MATERIAL -
ELEVATION / DEPTH OF HOLE: 33'

BORING NO.: MW302

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB	LOCATION: WICHITA FALLS, TX	DRILLER: G. POOL
PROJECT NO.: 7563	BORING: MW 302	DRILLING METHOD: AIR ROTARY
ELEVATION: 984.74	DATE: 11/13/88	DEVELOPMENT METHOD: AIR LIFT
FIELD GEOLOGIST: J. WEDEKIND		



ELEVATION OF TOP OF SURFACE CASING: 987.57

ELEVATION OF TOP OF RISER PIPE: 987.14

STICK - UP TOP OF SURFACE CASING: 2.83

STICK - UP RISER PIPE: 2.40

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 23

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 26

ELEVATION / DEPTH TOP OF SCREEN: 28

TYPE OF SCREEN: SCHEDULE 40 PVC

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2" x 10'

TYPE OF SAND PACK: 20-40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 38

ELEVATION / DEPTH BOTTOM OF SAND PACK: 43

TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND

ELEVATION / DEPTH OF HOLE: 43.0

BORING NO.: MW402

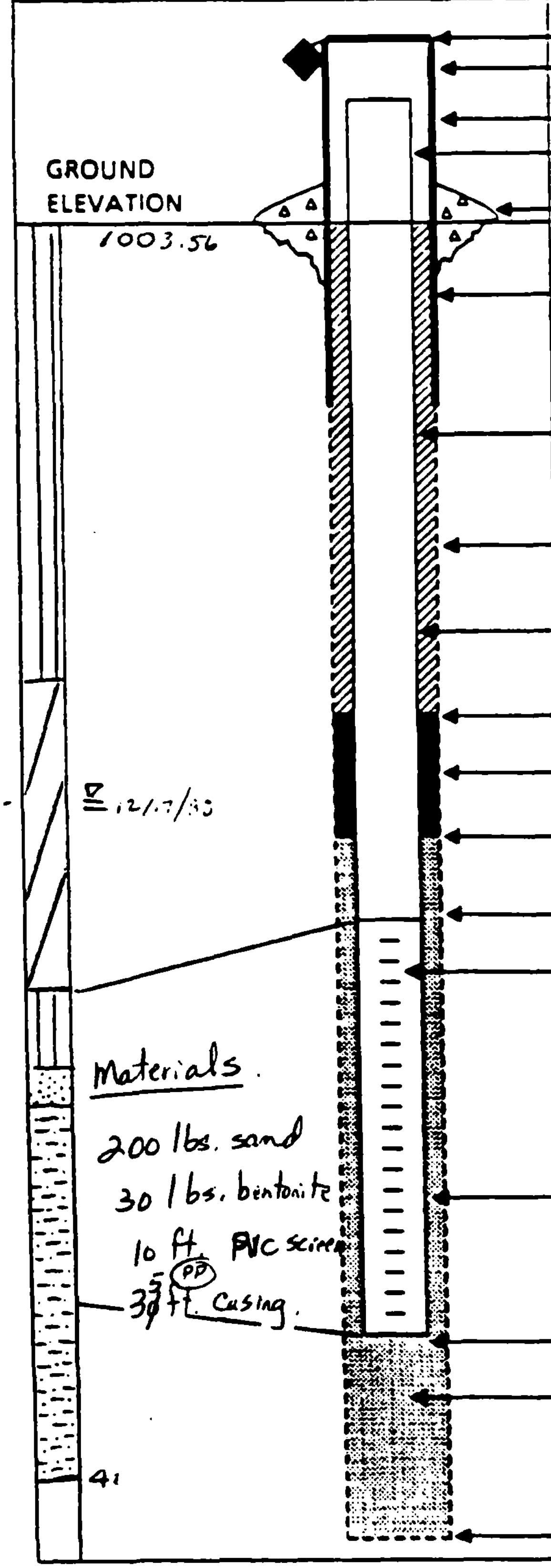
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT $AFB
PROJECT NO. 7663
ELEVATION 1003.56
FIELD GEOLOGIST J Wedekind, J. Lewis

LOCATION
BORING ~~B~~B402
DATE

DRILLER G. Pool
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift



ELEVATION OF TOP OF SURFACE CASING: 1,006.33
ELEVATION OF TOP OF RISER PIPE: 1,006.05
STICK - UP TOP OF SURFACE CASING: 2.77
STICK - UP RISER PIPE: 2.49
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: GALVANIZED STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 20
TYPE OF SEAL: BENTONITE PELLETS (1/4")
DEPTH TOP OF SAND PACK: 23
ELEVATION / DEPTH TOP OF SCREEN: 25
TYPE OF SCREEN: ~~Bentonite Pellets~~ PP SCHEDULE 40 PVC ~~.010" x 10'~~ PP
SLOT SIZE x LENGTH: .010" X 10'
I.D. OF SCREEN: 2" x 10'
TYPE OF SAND PACK: 20/40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 35
ELEVATION / DEPTH BOTTOM OF SAND PACK: 36
TYPE OF BACKFILL BELOW OBSERVATION WELL: ~~Hole plug~~ PP Natural material to T.D.
ELEVATION / DEPTH OF HOLE: 41

BORING NO.: MW 403

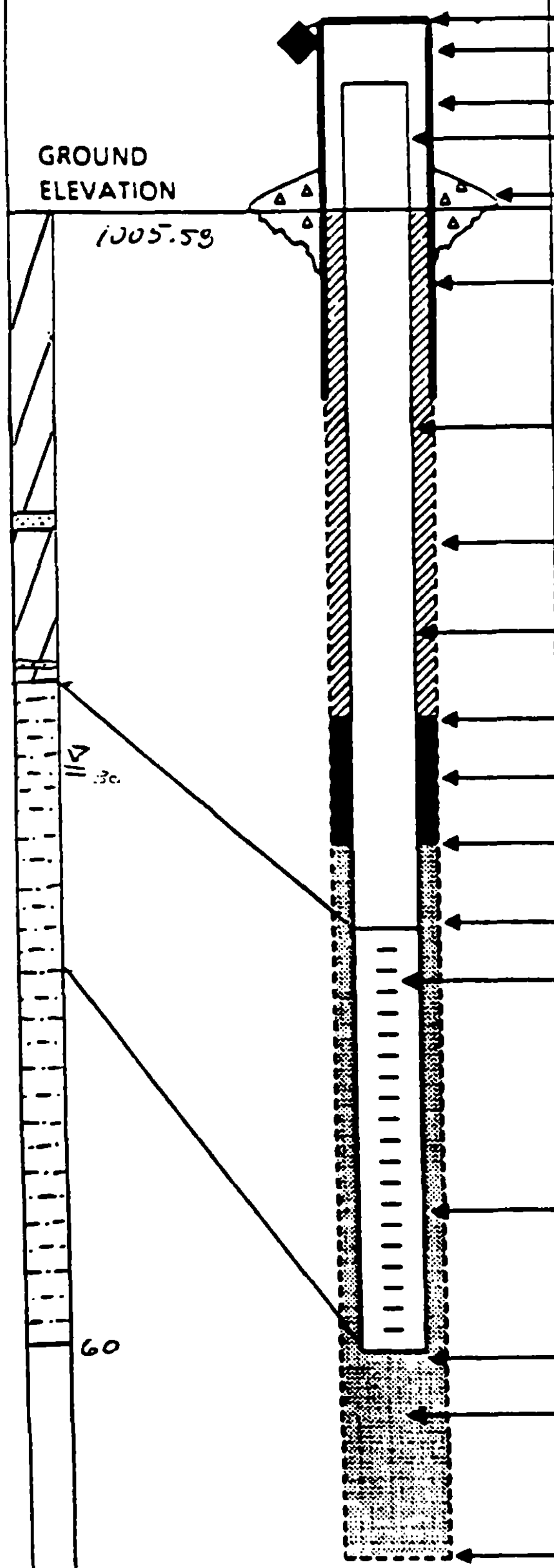
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
PROJECT NO.: 7863
ELEVATION: 1005.58
FIELD GEOLOGIST: J WEDEKIND

LOCATION: WICHITA FALLS, TX
BORING: MW 403
DATE: 12/14/88

DRILLER: W. CALDWELL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT / Bailing



ELEVATION OF TOP OF SURFACE CASING: 1008.38
ELEVATION OF TOP OF RISER PIPE: 1008.08
STICK - UP TOP OF SURFACE CASING: 2.80
STICK - UP RISER PIPE: 2.50
TYPE OF SURFACE SEAL: CONCRETE PAD 4×4×6"
I.D. OF SURFACE CASING: 6" × 5'
TYPE OF SURFACE CASING: ~~[illegible]~~ STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 20.5
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 23.5
ELEVATION / DEPTH TOP OF SCREEN: 25
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010 × 15'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 40
ELEVATION / DEPTH BOTTOM OF SAND PACK: 45
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG 60-45
— SEDIMENT TRAP 45-40 —
ELEVATION / DEPTH OF HOLE: 60'

BORING NO.: MW501

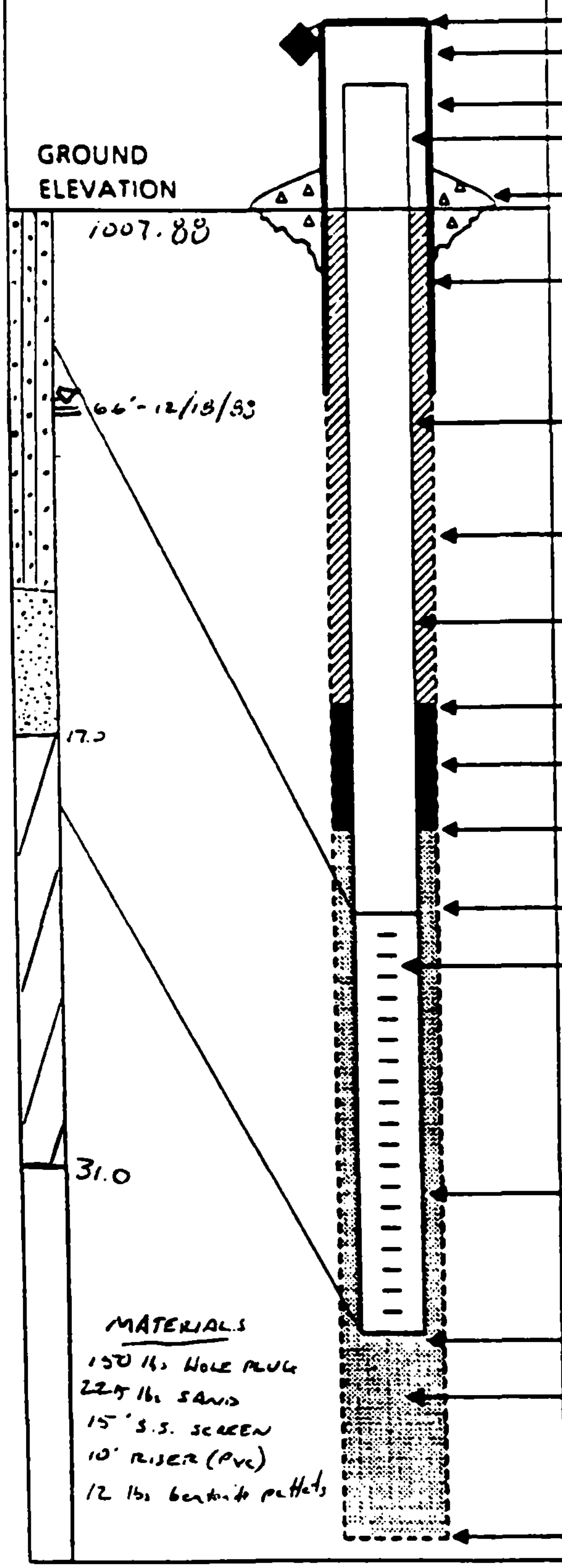
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT Sheppard AFB
PROJECT NO. 7$63
ELEVATION 1007.88
FIELD GEOLOGIST P. Pogue J. Wedekind

LOCATION Wichita Falls Tx
BORING MW501
DATE 12/10/88

DRILLER W Caldwell
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift/Bailing



ELEVATION OF TOP OF SURFACE CASING: 1007.88
ELEVATION OF TOP OF RISER PIPE: 1007.76

STICK - UP TOP OF SURFACE CASING: Flush Mount
STICK - UP RISER PIPE: -0.125

TYPE OF SURFACE SEAL: Concrete Pad

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: Steel × 5'

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 2.5

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 3.0

ELEVATION / DEPTH TOP OF SCREEN: 4.3

TYPE OF SCREEN: Stainless Steel

SLOT SIZE x LENGTH: 0.010 × 15'

I.D. OF SCREEN: 2" × 15'

TYPE OF SAND PACK: 20-40 Silica Sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 19.3

ELEVATION / DEPTH BOTTOM OF SAND PACK: 22.0

TYPE OF BACKFILL BELOW OBSERVATION WELL: 'Hole Plug (Bentonite Wafers) to 28'

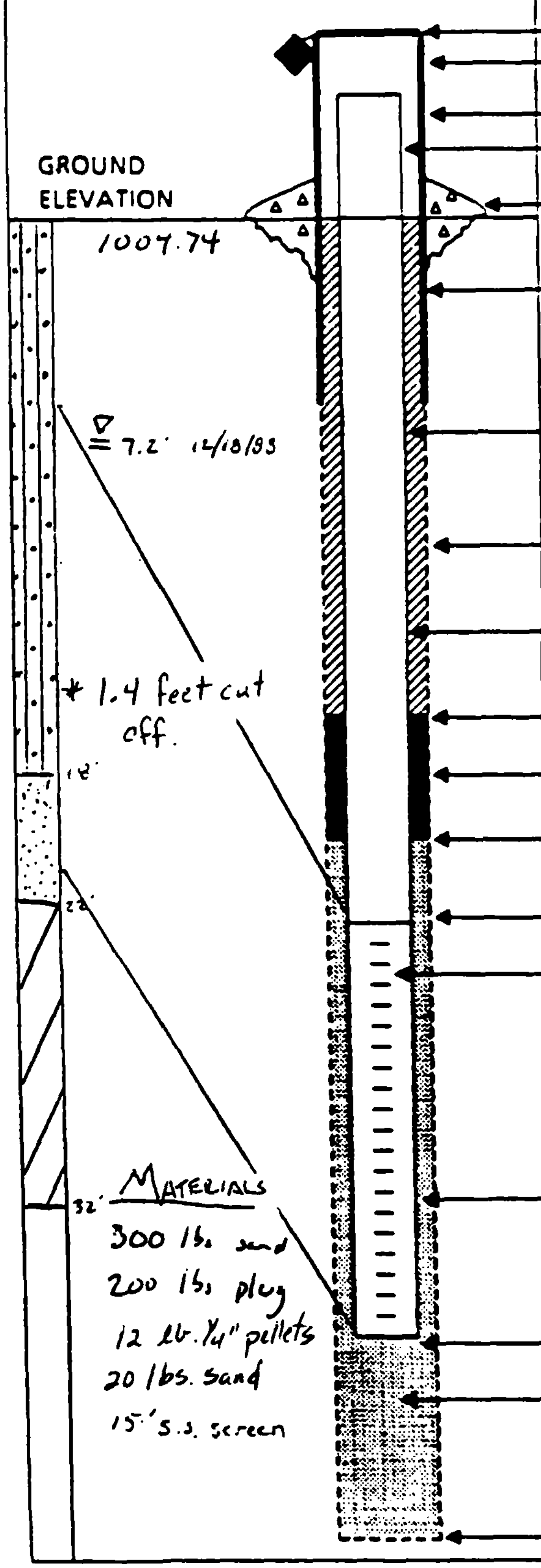
ELEVATION / DEPTH OF HOLE: 31.0

BORING NO.: MW502

NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: SAFB	LOCATION: Wichita Falls, TX	DRILLER: W. Caldwell
PROJECT NO.: 7863	BORING: MW502	DRILLING METHOD: Air Rotary
ELEVATION: 1004.74	DATE: 12-10-88	DEVELOPMENT METHOD: Air Lift
FIELD GEOLOGIST: J Wederkind D. Pogue		



ELEVATION OF TOP OF SURFACE CASING: 1004.74

ELEVATION OF TOP OF RISER PIPE: 1004.60

STICK - UP TOP OF SURFACE CASING: Flushmount

STICK - UP RISER PIPE: -0.14

TYPE OF SURFACE SEAL: Concrete Pad

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: Steel

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 4

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 5

ELEVATION / DEPTH TOP OF SCREEN: 6

TYPE OF SCREEN: Stainless Steel

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 Silica Sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 21

ELEVATION / DEPTH BOTTOM OF SAND PACK: 23

TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug (Bentonite)

ELEVATION / DEPTH OF HOLE: 32

BORING NO.: MW503

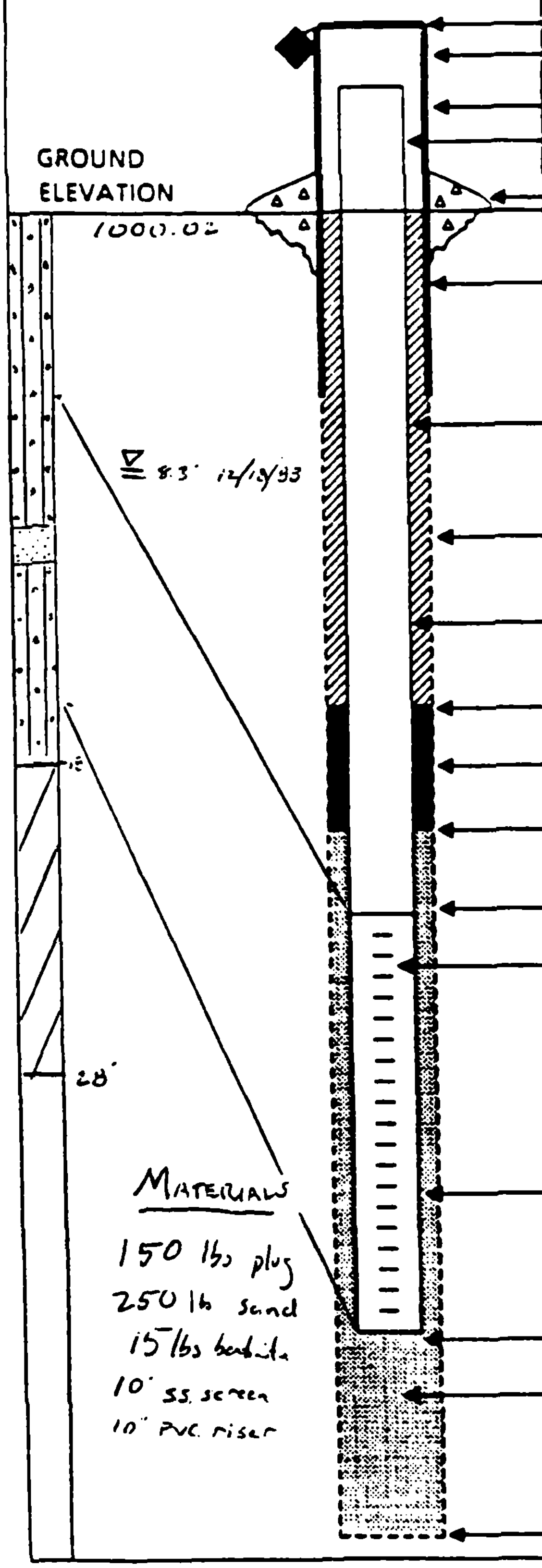
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT Sheppard AFB
PROJECT NO. 7563
ELEVATION 1000.02
FIELD GEOLOGIST R Pogue

LOCATION Wichita Falls TX
BORING MW503
DATE 12/10/88

DRILLER W Caldwell
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift



MATERIALS
150 lbs plug
250 lb sand
15 lbs bentonite
10' SS screen
10' PVC riser

ELEVATION OF TOP OF SURFACE CASING: 1000.02
ELEVATION OF TOP OF RISER PIPE: 999.84
STICK - UP TOP OF SURFACE CASING: FLUSH MOUNT
STICK - UP RISER PIPE: -0.18'
TYPE OF SURFACE SEAL: Concrete Pad
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 4'
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 5'
ELEVATION / DEPTH TOP OF SCREEN: 6'
TYPE OF SCREEN: Stainless Steel
SLOT SIZE x LENGTH: 0.010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 silica sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 16'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 18'
TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug - Bentonite
ELEVATION / DEPTH OF HOLE: 28

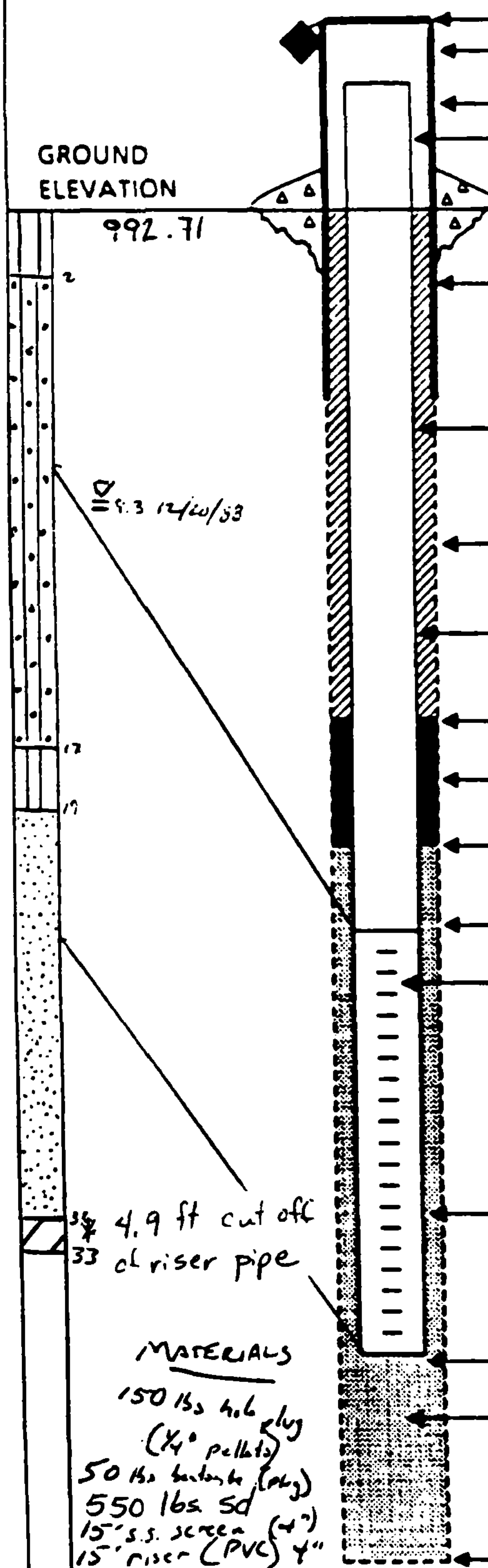
BORING NO.: SB 701

NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: Sheppard AFB
LOCATION: Wichita Falls, Tx
PROJECT NO.: 7563
BORING: MW 701
ELEVATION: 992.71
DATE: 12-07-88
FIELD GEOLOGIST: P. Pogue, J. Wedekind

DRILLER: W. Caldwell
DRILLING METHOD: Air Rotary
DEVELOPMENT METHOD: Air Lift



ELEVATION OF TOP OF SURFACE CASING: 995.20
ELEVATION OF TOP OF RISER PIPE: 994.97
STICK-UP TOP OF SURFACE CASING: 2.49
STICK-UP RISER PIPE: 2.26
TYPE OF SURFACE SEAL: Concrete pad
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: Galvanized steel
RISER PIPE I.D. 4"
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Volclay grout
ELEVATION / DEPTH TOP OF SEAL: 3.0
TYPE OF SEAL: Bentonite Pellets (1/4")
DEPTH TOP OF SAND PACK: 6.0
ELEVATION / DEPTH TOP OF SCREEN: 8.0
TYPE OF SCREEN: Stainless steel
SLOT SIZE x LENGTH: 0.010" x 15'
I.D. OF SCREEN: 4" x 15'
TYPE OF SAND PACK: 20-40 silica sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 23.0
ELEVATION / DEPTH BOTTOM OF SAND PACK: 26.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug to 26.0
ELEVATION / DEPTH OF HOLE: 32.9

BORING NO.: MW 702

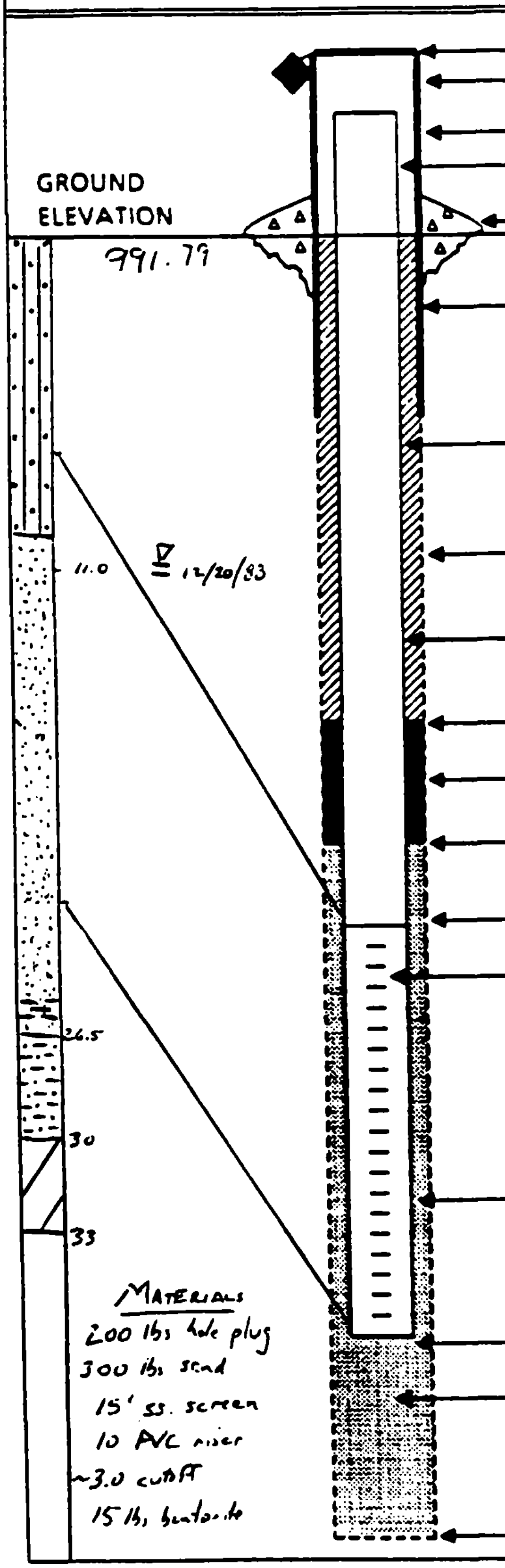
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT SHEPPARD AFB
PROJECT NO. 7863
ELEVATION 991.79
FIELD GEOLOGIST J. WEDEKIND

LOCATION WICHITA FALLS, TX
BORING MW 702
DATE 12/10/83

DRILLER W. CALDWELL
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD AIR LIFT / BAILING



ELEVATION OF TOP OF SURFACE CASING: 994.94
ELEVATION OF TOP OF RISER PIPE: 994.26

STICK - UP TOP OF SURFACE CASING: 3.15
STICK - UP RISER PIPE: 2.47

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL x 5'

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 4.0

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 5.5

ELEVATION / DEPTH TOP OF SCREEN: 7.0

TYPE OF SCREEN: STAINLESS STEEL

SLOT SIZE x LENGTH: 0.010 x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20 - 40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 22.0

ELEVATION / DEPTH BOTTOM OF SAND PACK: 24.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG (Bentonite WAFERS)

ELEVATION / DEPTH OF HOLE: 33.0

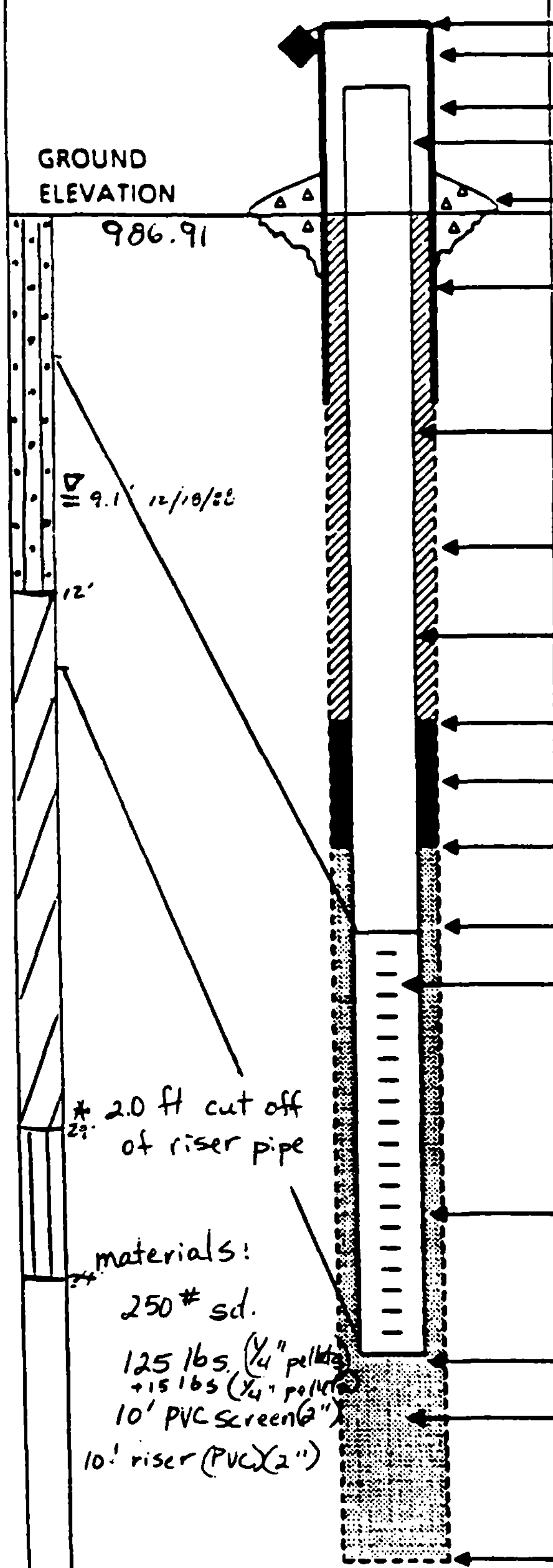
NUS CORPORATION

BORING NO.: MW-801

OVERBURDEN MONITORING WELL SHEET

PROJECT Sheppard AFB
LOCATION Wichita Falls, Tx.
PROJECT NO. 7863
BORING MW-801
ELEVATION 986.91
DATE 12-07-88
FIELD GEOLOGIST P. POGUE, T. Wedekind

DRILLER W. Caldwell
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift



ELEVATION OF TOP OF SURFACE CASING: 989.69

ELEVATION OF TOP OF RISER PIPE: 989.48

STICK - UP TOP OF SURFACE CASING: 2.78

STICK - UP RISER PIPE: 2.57

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay grout

ELEVATION / DEPTH TOP OF SEAL: 2.5

TYPE OF SEAL: 1/4" bentonite pellets

DEPTH TOP OF SAND PACK: 3.5'

ELEVATION / DEPTH TOP OF SCREEN: 4.5'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 silica sand.

ELEVATION / DEPTH BOTTOM OF SCREEN: 14.5'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 16.5'

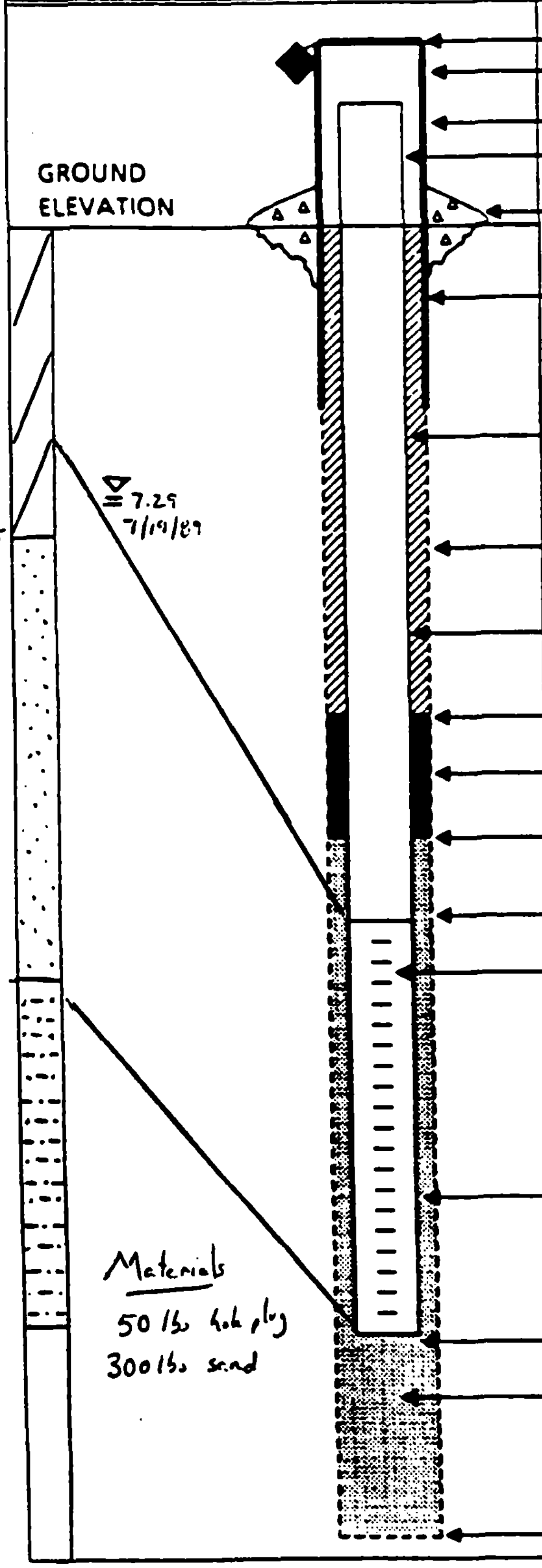
TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole plug to 29.5 Caving to T.D.

ELEVATION / DEPTH OF HOLE: 34.0

BORING NO.: MW 802

OVERBURDEN
MONITORING WELL SHEET

PROJECT SHEPPARD AFB	LOCATION Wichita Falls, TX	DRILLER W. Caldwell
PROJECT NO. 7863	BORING MW802	DRILLING METHOD Air Rotary
ELEVATION	DATE 7/14/89	DEVELOPMENT METHOD Air Lift/Bailing
FIELD GEOLOGIST J Wedekind		



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: -0.25

STICK - UP RISER PIPE: -0.40

TYPE OF SURFACE SEAL: CONCRETE PAD 3'x3' (FLUSH MOUNT)

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: 6" STEEL x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 3.0

TYPE OF SEAL: Bentonite Pellets (1/4")

DEPTH TOP OF SAND PACK: 5.0

ELEVATION / DEPTH TOP OF SCREEN: 6.0

TYPE OF SCREEN: SCHEDULE 40 PVC

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 21

ELEVATION / DEPTH BOTTOM OF SAND PACK: 23

TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug

ELEVATION / DEPTH OF HOLE: 30

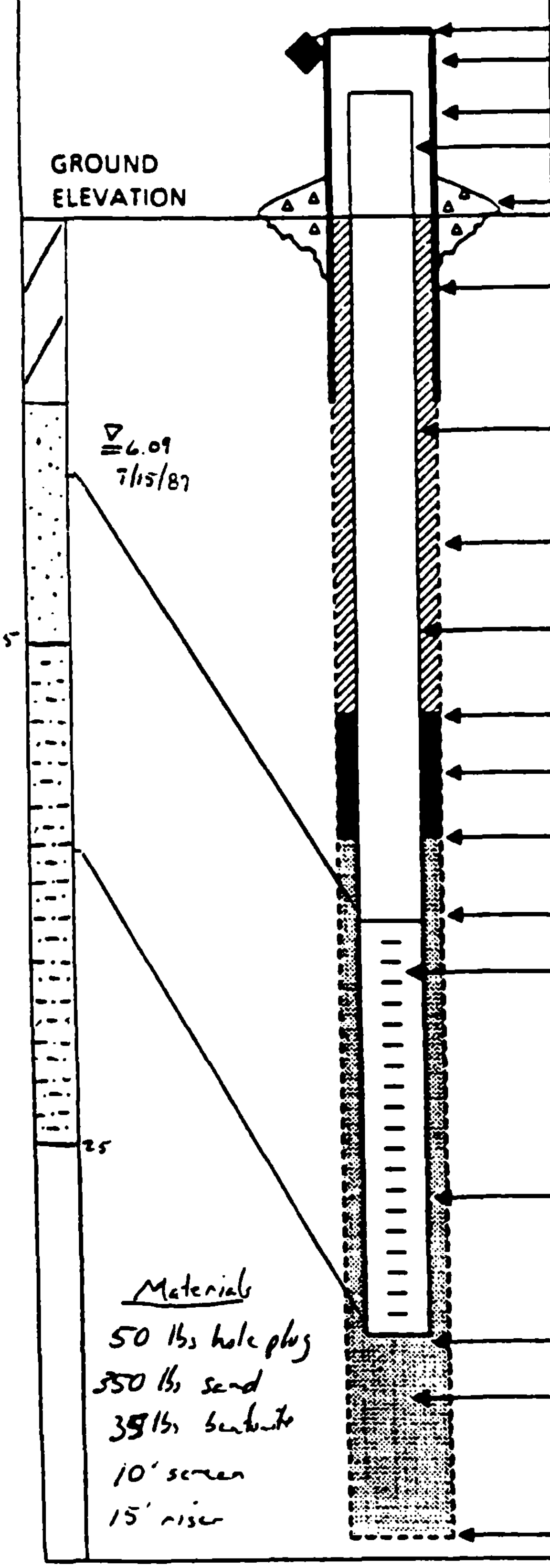
BORING NO.: MW 803

NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
LOCATION: WICHITA FALLS, TX
PROJECT NO.: 7$63
BORING: MW 803
ELEVATION:
DATE: 7/15/89
FIELD GEOLOGIST: J. WEDEKIND

DRILLER: W. CALDWELL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT/BAILING



Materials
50 lbs hole plug
350 lbs sand
35 lbs bentonite
10' screen
15' riser

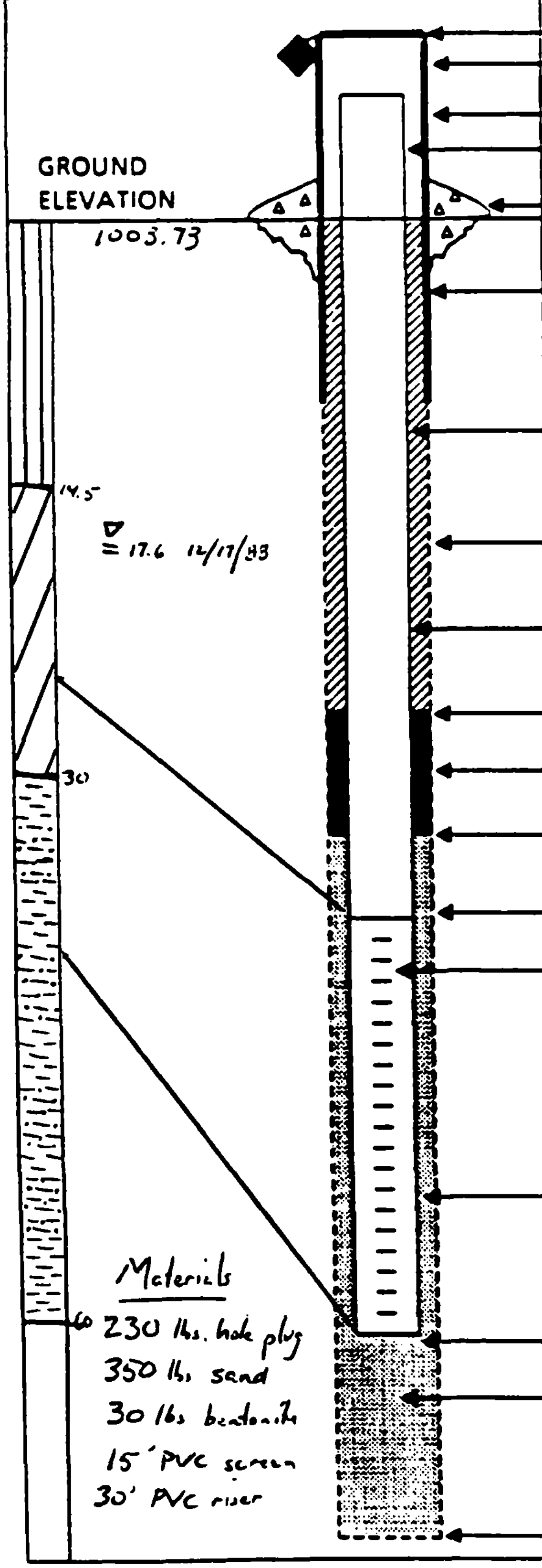
ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 2.89'
STICK - UP RISER PIPE: 2.63'
TYPE OF SURFACE SEAL: CONCRETE PAD 3'x3'
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL x 5'
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 3.0
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 5.0
ELEVATION / DEPTH TOP OF SCREEN: 7.0
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010" x 10'
I.D. OF SCREEN: ~~Schedule 40 PVC~~ 2"
TYPE OF SAND PACK: 20-40
ELEVATION / DEPTH BOTTOM OF SCREEN: 18
ELEVATION / DEPTH BOTTOM OF SAND PACK: 20
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG
ELEVATION / DEPTH OF HOLE: 25

NUS CORPORATION

BORING NO.: MW11-1

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB	LOCATION: WICHITA FALLS, TX	DRILLER: W. CALDWELL
PROJECT NO.: 7863	BORING: MW11-1	DRILLING METHOD: AIR ROTARY
ELEVATION: 1003.73	DATE: 12/13/88	DEVELOPMENT METHOD: AIR LIFT/BAILING
FIELD GEOLOGIST: J. WEDEKIND, P. POGUE		



ELEVATION OF TOP OF SURFACE CASING: 1006.46

ELEVATION OF TOP OF RISER PIPE: 1006.25

STICK - UP TOP OF SURFACE CASING: 2.73

STICK - UP RISER PIPE: 2.52

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 20

TYPE OF SEAL: Bentonite Pellets (¼")

DEPTH TOP OF SAND PACK: 23

ELEVATION / DEPTH TOP OF SCREEN: 25

TYPE OF SCREEN: SCHEDULE 40 PVC

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 40

ELEVATION / DEPTH BOTTOM OF SAND PACK: 45

TYPE OF BACKFILL BELOW OBSERVATION WELL: "HOLE PLUG" (BENTONITE WAFERS) to 45'

ELEVATION / DEPTH OF HOLE: 60

BORING NO.: BB01

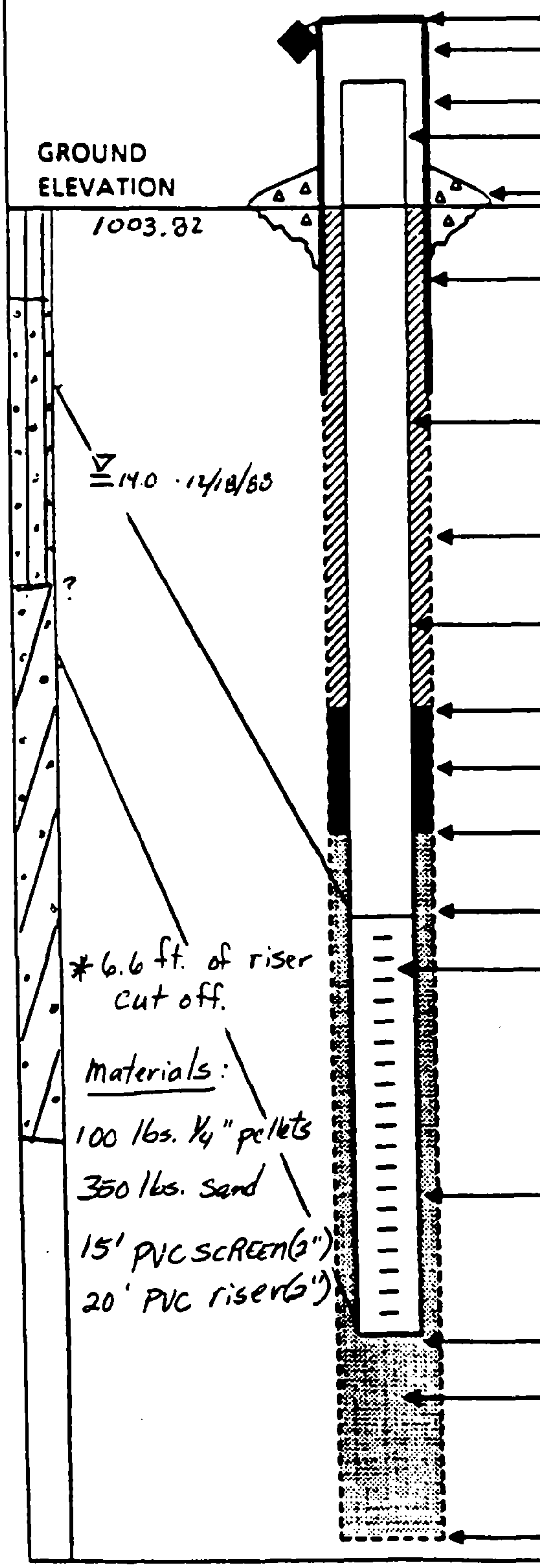
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SAFB
PROJECT NO.: 7563
ELEVATION: 1003.82
FIELD GEOLOGIST: J. Wedekind, P. Pogue

LOCATION: WICHITA FALLS TX
BORING: BB01
DATE: 12-08-88

DRILLER: W. Caldwell
DRILLING METHOD: Air Rotary
DEVELOPMENT METHOD: Air Lift



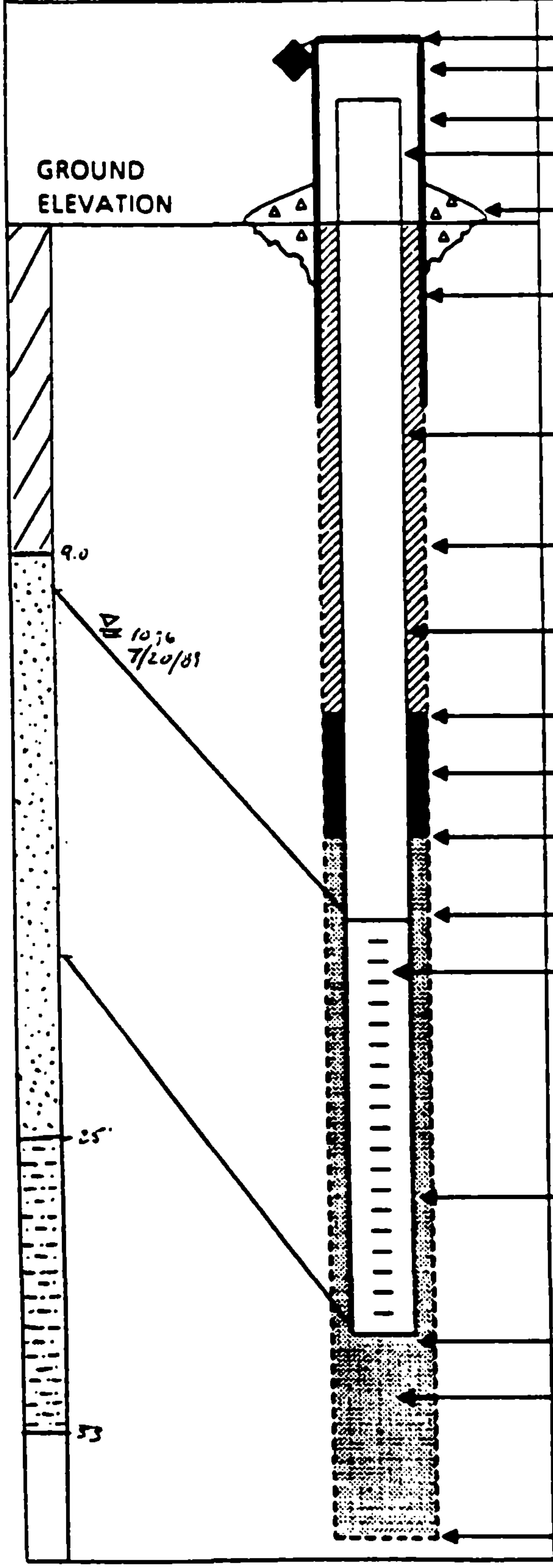
ELEVATION OF TOP OF SURFACE CASING: 1006.42
ELEVATION OF TOP OF RISER PIPE: 1005.67
STICK - UP TOP OF SURFACE CASING: 2.6
STICK - UP RISER PIPE: 1.85
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: GALVANIZED STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 6.5
TYPE OF SEAL: Bentonite Pellets (1/4")
DEPTH TOP OF SAND PACK: 7.5
ELEVATION / DEPTH TOP OF SCREEN: 9.5
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 0.010" x 15 ft.
I.D. OF SCREEN: 2" x 15'
TYPE OF SAND PACK: 20-40 Silica sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 24.5
ELEVATION / DEPTH BOTTOM OF SAND PACK: 26.5
TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole plug to 31.0'; cuttings to T.D.
ELEVATION / DEPTH OF HOLE: 50.0

BORING NO.: MW13-1

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
PROJECT NO.: 7563
ELEVATION:
FIELD GEOLOGIST: J. WEDEKIND
LOCATION: Wichita Falls Tx
BORING: MW13-1
DATE: 7/16/89
DRILLER: W CALDWELL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT/BAILING



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 3.07
STICK - UP RISER PIPE: 2.80
TYPE OF SURFACE SEAL: CONCRETE PAD 3' × 3'
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL × 5'
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 6'
TYPE OF SEAL: BENTONITE PELLETS (¼")
DEPTH TOP OF SAND PACK: 8'
ELEVATION / DEPTH TOP OF SCREEN: 10'
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010" × 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 20'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 22'
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE CAVED-IN — NATURAL MATERIAL
ELEVATION / DEPTH OF HOLE: 33'

BORING NO.: MW13-2

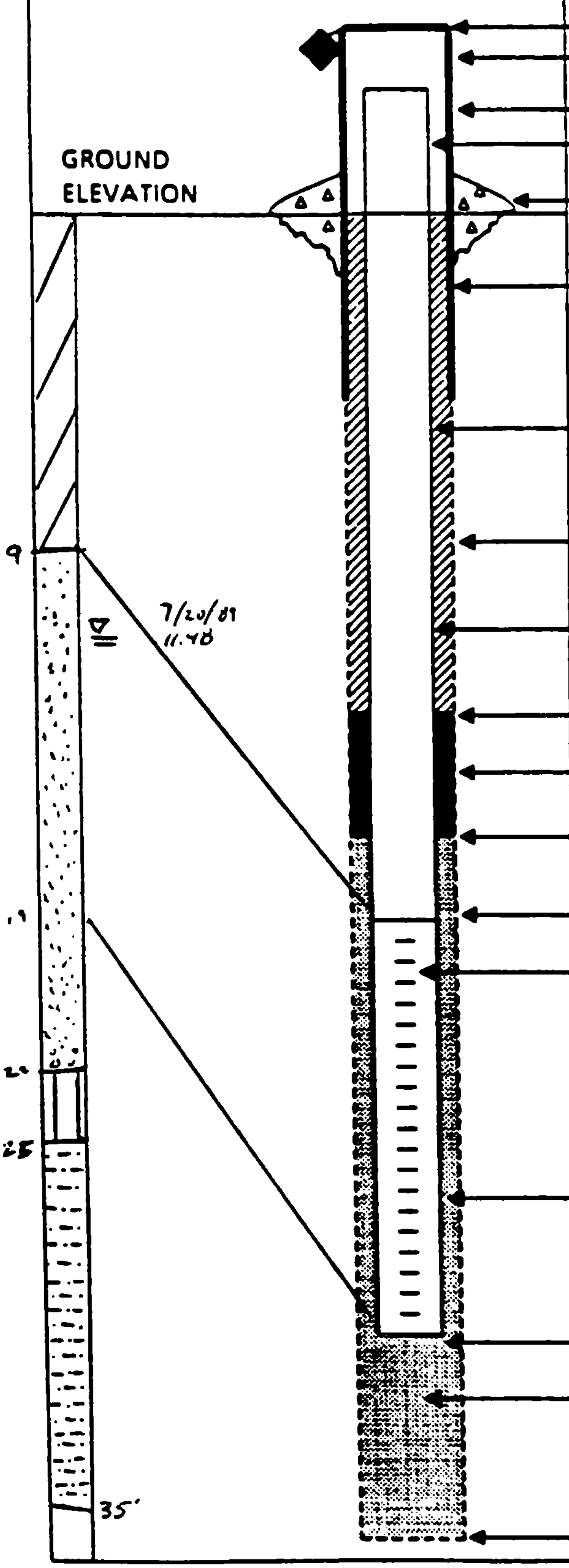
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
PROJECT NO.: 7563
ELEVATION:
FIELD GEOLOGIST: J. WEDEKIND

LOCATION: Wichita Falls, TX
BORING: MW13-2
DATE: 7/17/89

DRILLER: W. CALDWELL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT / BAILING



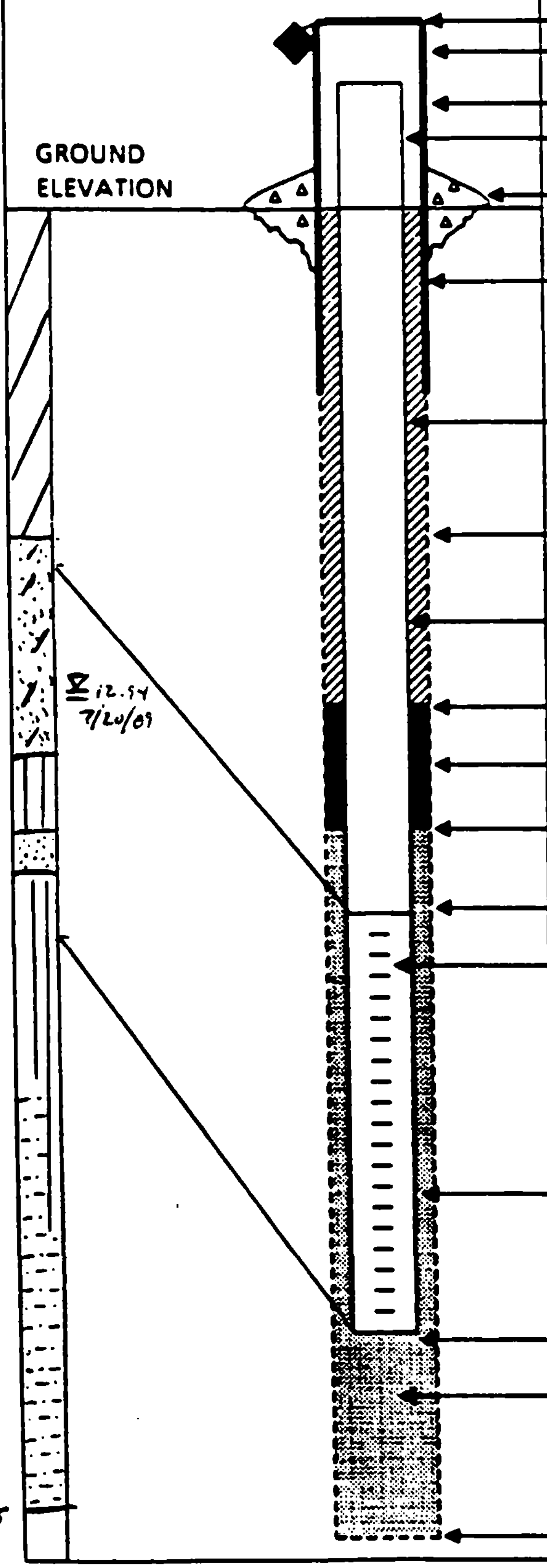
ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING: 2.83
STICK-UP RISER PIPE: 2.65
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL × 5'
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 3.5'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 7'
ELEVATION / DEPTH TOP OF SCREEN: 9'
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010" × 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 19'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 21'
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE CAVED-IN to 21' – NATURAL MATERIAL –
ELEVATION / DEPTH OF HOLE: 35'

BORING NO.: MW13-3

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT SHEPPARD AFB	LOCATION WICHITA FALLS, TX	DRILLER W. CALDWELL
PROJECT NO. 7563	BORING MW13-3	DRILLING METHOD AIR ROTARY
ELEVATION	DATE 7/16/89	DEVELOPMENT METHOD AIR LIFT / BAILING
FIELD GEOLOGIST J. WEDEKIND		



ELEVATION OF TOP OF SURFACE CASING: ______

ELEVATION OF TOP OF RISER PIPE: ______

STICK - UP TOP OF SURFACE CASING: -0.14'

STICK - UP RISER PIPE: -0.36'

TYPE OF SURFACE SEAL: CONCRETE PAD AND CHRISTY BOX - FLUSH MOUNT

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 5.5'

TYPE OF SEAL: BENTONITE PELLETS (¼")

DEPTH TOP OF SAND PACK: 6.6'

ELEVATION / DEPTH TOP OF SCREEN: 9.7'

TYPE OF SCREEN: SCHEDULE 40 PVC

SLOT SIZE x LENGTH: 0.010" x 5'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 19.7'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 20'

TYPE OF BACKFILL BELOW OBSERVATION WELL: BORING CAVED-IN NATURAL MATERIAL

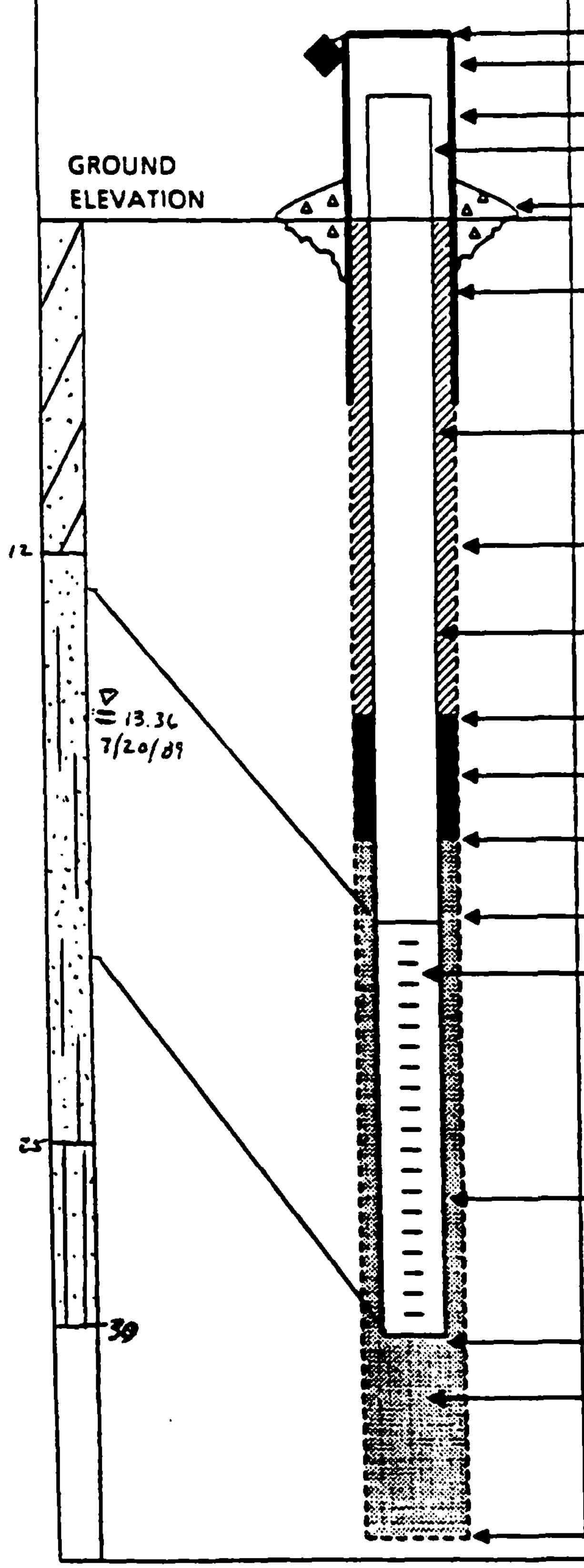
ELEVATION / DEPTH OF HOLE: 35'

BORING NO.: MW 13-4

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB PROJECT NO. 7563 ELEVATION FIELD GEOLOGIST: J. WEDEKIND	LOCATION: WICHITA FALLS, TX BORING: MW 13-4 DATE: 7/17/89	DRILLER: W. CALDWELL DRILLING METHOD: AIR ROTARY DEVELOPMENT METHOD: AIR LIFT/BAILING



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: -0.20

STICK - UP RISER PIPE: -0.38

TYPE OF SURFACE SEAL: CONCRETE PAD AND CHRISTY BOX (FLUSH MOUNT)

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 6'

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 8'

ELEVATION / DEPTH TOP OF SCREEN: 10'

TYPE OF SCREEN: SCHEDULE 40 PVC

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 20'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 22'

TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG 27.6-22' HOLE CAVED-IN TO 27.6

ELEVATION / DEPTH OF HOLE: 30

C

APPENDIX C

WATER-LEVEL DATA AND HYDROGEOLOGIC CALCULATIONS

TABLE C-1

SHEPPARD AIR FORCE BASE
WATER LEVEL ELEVATIONS
JANUARY 17, 1989

Site	Well Number	Well Top Elevation (MSL)[a]	Water Level - BTOC[b]	Water Level Elevation (MSL)
FT01	MW11	1016.29	8.14	1008.15
	MW12	1007.60	7.24	1000.36
	MW13	1009.42	7.48	1001.94
	MW14	998.21	4.93	993.28
	MW501	1007.76	6.61	1001.15
	MW502	1004.60	7.04	997.56
	MW503	999.84	8.29	991.55
FT03	MW8	1001.30	12.36	988.94
	MW9	995.84	11.27	984.57
	MW10	995.43	11.86	983.57
	MW701	994.97	11.33	983.64
	MW702	994.26	11.07	983.19
LF04	MW301	976.34	9.40	966.94
	MW302	987.14	12.19	974.95
	MW303	1012.66	45.94[c]	966.72
LF05	MW201	1008.04	17.78	990.26
	MW202	1001.87	40.02	961.85
LF06	MW4	994.78	9.47	985.31
	MW7	1029.67	11.20	1018.47
	MW402	1006.05	11.22	994.83
	MW403	1008.08	19.25	988.23
RW08	MW11-1	1006.25	10.81	995.44
WP10	MW801	989.48	8.93	980.55
BB	BB01	1005.67	13.74	991.93

(a) Mean Sea Level
(b) Below top of casing
(c) Well not recharged

TABLE C-2

SHEPPARD AIR FORCE BASE
WATER LEVEL ELEVATIONS
JULY 19-20, 1989

Site	Well Number	Well Top Elevation (MSL)[a]	Water Level - BTOC[b]	Water Level Elevation (MSL)
FT01	MW11	1016.29	5.95	1010.34
	MW12	1007.60	4.38	1003.22
	MW13	1009.42	4.61	1004.81
	MW14	998.21	3.05	995.16
	MW501	1007.76	3.45	1004.31
	MW502	1004.60	4.27	1000.33
	MW503	999.84	5.88	993.96
FT03	MW8	1001.30	10.72	990.58
	MW9	995.84	8.42	987.42
	MW10	995.43	9.93	985.50
	MW701	994.97	8.60	986.37
	MW702	994.26	8.26	986.00
LF04	MW301	976.34	8.24	968.10
	MW302	987.14	12.39	974.75
	MW303	1012.66	11.49	1001.17
LF05	MW201	1008.04	15.73	992.31
	MW202	1001.87	39.40[c]	962.47
	MW204	1010.39	15.75	994.64
LF06	MW4	994.78	8.05	986.73
	MW7	1029.67	9.82	1019.85
	MW402	1006.05	7.95[d]	998.10
	MW403	1008.08	11.02	997.06
RW08	MW11-1	1006.25	10.56	995.69
WP10	MW801	989.48	8.21	981.27
	MW802	992.18	6.89	985.29
	MW803	988.89	8.72	980.17
ST13	MW13-1	1046.84	13.76	1033.08
	MW13-2	1046.92	14.13	1032.79
	MW13-3	1043.49	12.94	1030.55
	MW13-4	1043.56	12.98	1030.58

(a) Mean Sea Level
(b) Well had not recharged - water level on 07/11/89.
(c) Well had not recharged - water level on 07/17/89.
(d) Below top of casing.

TABLE C-3

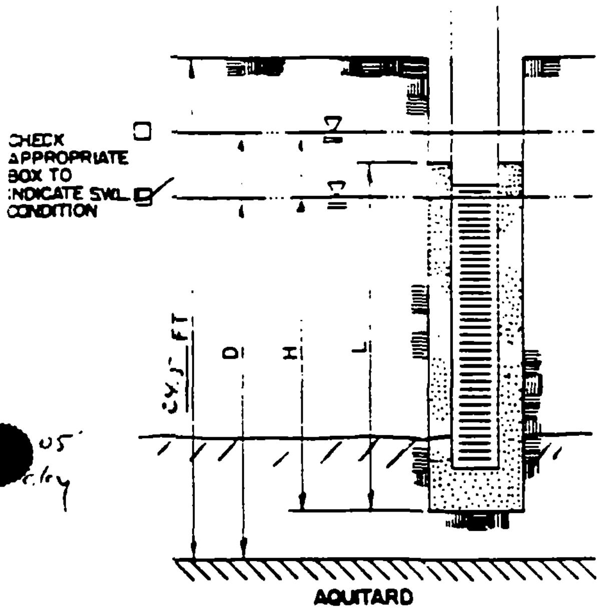
SHEPPARD AIR FORCE BASE
SUMMARY OF HYDRAULIC CONDUCTIVITIES
DERIVED FROM SLUG TESTS

Monitoring Well Number	Hydraulic Conductivity (K) cm/sec	K of Second Test (If conducted) cm/sec
MW201	7.20×10^{-4}	--
MW202	7.28×10^{-5}	--
MW301	9.73×10^{-5}	--
MW302	6.88×10^{-4}	8.35×10^{-4}
MW303	6.36×10^{-5}	--
MW402	4.04×10^{-5}	7.83×10^{-5}
MW403	1.12×10^{-5}	3.41×10^{-5}
MW501	7.03×10^{-4}	4.36×10^{-4}
MW502	4.47×10^{-4}	4.42×10^{-4}
MW503	2.88×10^{-3}	7.84×10^{-4}
MW701	6.70×10^{-4}	5.33×10^{-4}
MW702	1.20×10^{-3}	2.10×10^{-4}
MW801	1.51×10^{-3}	--
MW11-1	2.00×10^{-5}	--

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: Sheppard AFB
JOB NUMBER: 7163
WELL NUMBER: MW201

TEST BY/DATE: P. [illegible] 1/-/89
CALCULATED BY/DATE: J. Woodhead 1/22/89
CHECKED BY/DATE: J. Lewis 9/-/89



.05'
clay

Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 17.72 ft. (below top of casing) B.T.O.C.

Top ~~Filter Pack~~ Screen = 17.67 ft. B.T.O.C.

Bott. ~~Filter Pack~~ Screen = 34.27 ft. B.T.O.C. *

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.55 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

* Because screen is set into a clay unit, the top of the clay is considered equivalent to the bottom of the screen for the purposes of the test.

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 9.27 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 9.27 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 9.27 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = n/a, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$K = 7.20 \times 10^{-4}$ cm/sec

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = ______).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 37.08).

C = 2.31 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0, T_t = 75, Y_o = 2.25, Y_t = 1.34

$$T = T_t - T_o = 75 \text{ (sec)}$$

Complete Page 5 in its entirety.

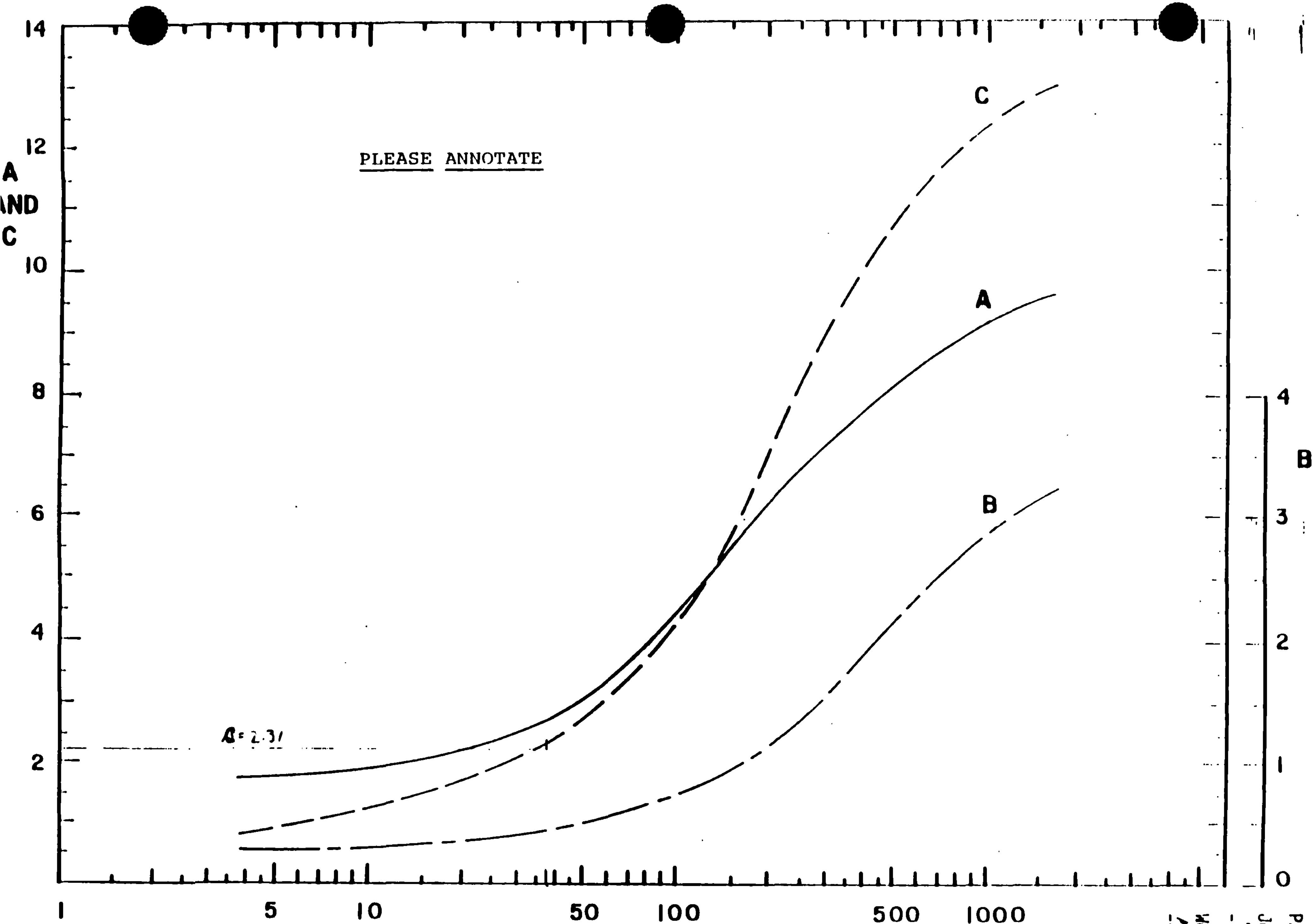


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

Well No

Job No.

PAGE

PLOT y versus t (from field data, attached at back):

where:

- t = time measured in field during slug test
- y = depth to static water table minus depth to falling water level (for slug injection)

or

- y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 / t (min.)	S.W.L. = 17.78 / y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	2.29				
	0.01	2.30				
	0.03	2.28				
	0.10	2.20				
	0.15	2.14				
	0.20	2.08				
	0.25	2.03				
	0.30	1.97				
	0.50	1.78				
	0.75	1.59				
	1.00	1.44				
t_o	1.25	1.34				
	1.50	1.27				
	1.75	1.21				
t_t	2.00	1.17				
	2.50	1.10				
	3.0	1.06				
	4.0	1.00				
	5.0	0.96				
	6.0	0.93				
	7.0	0.90				
	10.0	0.83				
	20.0	0.70				

Job No. 7&5
Well No. MW201

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)
B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 2.31 (N/A if not applicable)

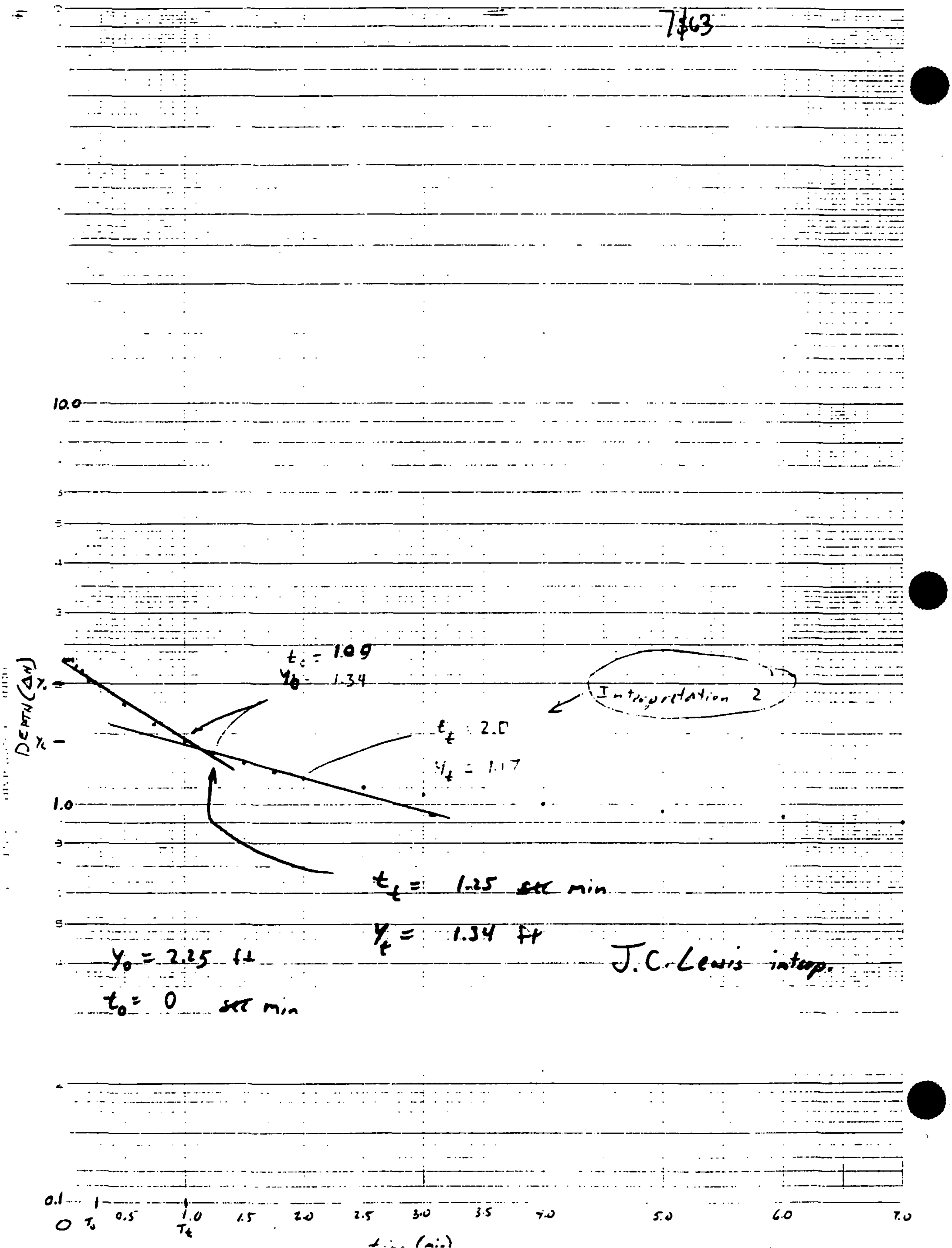
D, Depth to Impermeable Boundary (ft) = 9.27
D_d = ln[(D - H)/Rw] = NA (must be ≤6)
H, Height of Well Below Water Table (ft) = 9.27
L, Height Through Which Water Enters Well (ft) = 9.27
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 75
Y_o, Starting Y (ft) = 2.25
Y_t, Ending Y (ft) = 1.34

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): See previous note.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

MW201

7563



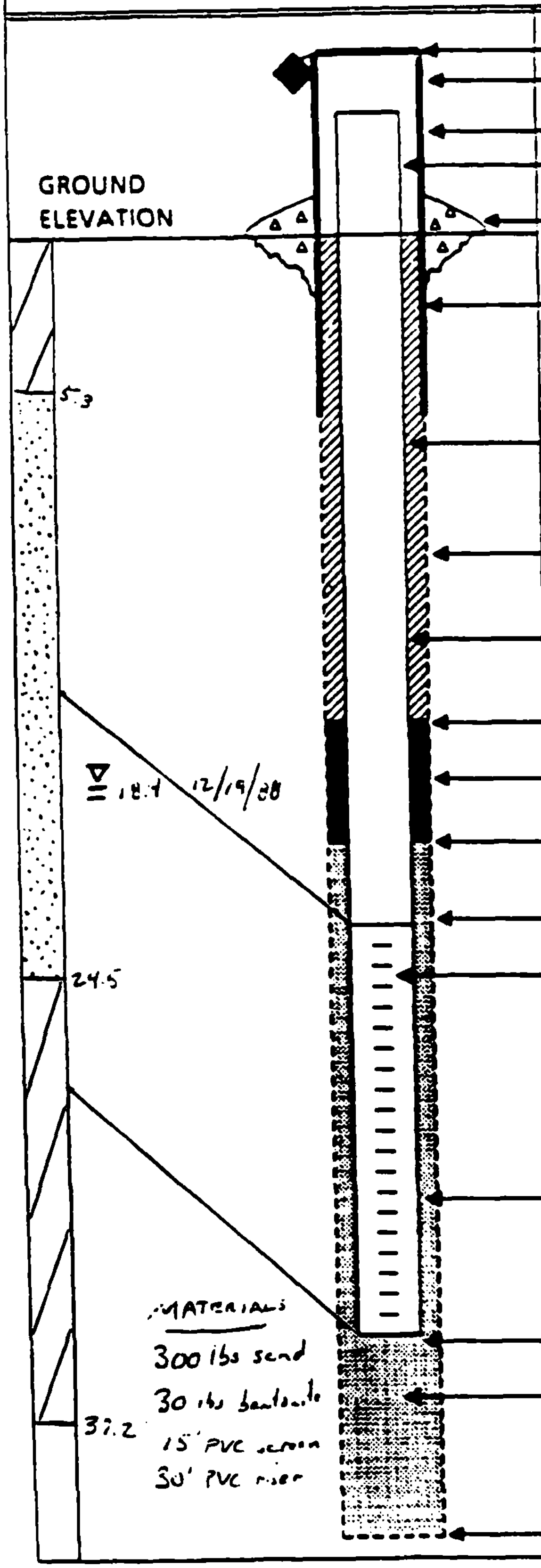
10.0
1.0
0.1
DEPTH (ΔH)
Y_0
Y_t
t_i = 1.09
Y_0 = 1.34
Interpretation 2
t_t = 2.0
Y_t = 1.17
t_t = 1.25 min
Y_t = 1.34 ft
Y_0 = 2.25 ft
t_0 = 0 min
J.C. Lewis interp.
0
T_0
0.5
1.0
T_t
1.5
2.0
2.5
3.0
3.5
4.0
5.0
6.0
7.0
time (min)

BORING NO.: MW201

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB	LOCATION: WICHITA FALLS, TX	DRILLER: G. Pool
PROJECT NO.: 7863	BORING: MW201	DRILLING METHOD: Air Rotary
ELEVATION:	DATE: 11/10/88	DEVELOPMENT METHOD: Air Lift/Bailing
FIELD GEOLOGIST: J. WEDEKIND		



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: 2.67

STICK - UP RISER PIPE: 2.55

TYPE OF SURFACE SEAL: CONCRETE POD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL ≈ 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 8.0

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 11.0

ELEVATION / DEPTH TOP OF SCREEN: 13.0

TYPE OF SCREEN: SCHEDULE 40 PVC

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 28.0

ELEVATION / DEPTH BOTTOM OF SAND PACK: 31.6

TYPE OF BACKFILL BELOW OBSERVATION WELL: Bentonite Pellets

ELEVATION / DEPTH OF HOLE: 39.2

Displag 0

NUS CORPORATION

WELL NO.: MW201 ELEVATION: ______ DATE: 1/17/89
STATIC WATER LEVEL 17.78 + CORRECTION D.L = 17.78 TIME 090
ELEVATION WATER ______ REFERENCE INPUT 17.78 XD: 7.15

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	20.07	
	001	0.0033	20.05	
	002	0.0067	20.08	
	003	0.0100	20.10	
✓	004	0.0133	20.09	
	005	0.0167	20.04	
	006	0.0200	20.05	
	007	0.0233	20.10	
	008	0.0267	20.09	
✓	009	0.0300	20.06	
	010	0.0333	20.06	
	011	0.0500	20.04	
	012	0.0667	20.02	
	013	0.0833	20.00	
✓	014	0.1000	19.98	
	015	0.1167	19.96	
	016	0.1333	19.94	
✓	017	0.1500	19.92	
	018	0.1667	19.90	
	019	0.1833	19.88	
✓	020	0.2000	19.86	
	021	0.2167	19.84	
	022	0.2333	19.82	
✓	023	0.2500	19.81	
	024	0.2667	19.79	
	025	0.2833	19.77	
✓	026	0.3000	19.75	
	027	0.3167	19.73	
	028	0.3333	19.72	
	029	0.4167	19.64	
✓	030	0.5000	19.56	
	031	0.5833	19.49	
	032	0.6667	19.43	
✓	033	0.7500	19.37	
	034	0.8333	19.31	
	035	0.9167	19.27	
✓	036	1.0000	19.22	
	037	1.0833	19.18	
✓	038	1.1667	19.15	
✓	039	1.2500	19.12	
	040	1.3333	19.09	
	041	1.4167	19.07	
✓	042	1.5000	19.05	
	043	1.5833	19.02	
	044	1.6667	19.00	

	Sample Number	Time (min)	
✓	045	1.7500	18.99
	046	1.8333	18.97
	047	1.9167	18.96
✓	048	2.0000	18.95
✓	049	2.5	18.88
✓	050	3.0	18.84
	051	3.5	18.90
✓	052	4.0	18.78
	053	4.5	18.76
✓	054	5.0	18.74
	055	5.5	18.72
✓	056	6.0	18.71
	057	6.5	18.69
✓	058	7.0	18.68
	059	7.5	18.66
	060	8.0	18.65
	061	8.5	18.64
	062	9.0	18.63
	063	9.5	18.62
✓	064	10.0	18.61
	065	12.0	18.58
	066	14.0	18.55
	067	16.0	18.52
	068	18.0	18.50
✓	069	20.0	18.48
	070	22.0	18.45
	071	24.0	18.44
	072	26.0	18.42
	073	28.0	18.41
✓	074	30.0	18.40
	075	32.0	18.38
	076	34.0	18.37
	077	36.0	18.35
	078	38.0	18.34
	079	40.0	18.33
	080	42.0	18.32
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis, Rev. 0, 2-17-89

DATE: SEPTEMBER 5, 1989
JOB NO: 7563
WELL NO: MW201
CALC BY: J C LEWIS

INPUT DATA (FROM DATA SHEET) (if no value, leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	2.31
D, DEPTH TO IMPERMEABLE BOUNDARY (ft) =	9.27
Dd, = ln((D-H)/Rw) =	
H, HEIGHT OF WELL BELOW WATER TABLE (ft) =	9.27
L, HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	9.27
Rw, RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T, TIME IN SECONDS (Tt-To) =	75
Yo, STARTING Y (ft) =	2.25
Yt, ENDING Y (ft) =	1.34

CALCULATE Rc

Rc = 0.152413

CONDITION 1, PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.284616

CONDITION 2, FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.726672

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW,
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING, ln(Re/Rw) = 3.284616
FULLY PENETRATING, ln(Re/Rw) = 2.726672

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.726672

CALCULATION

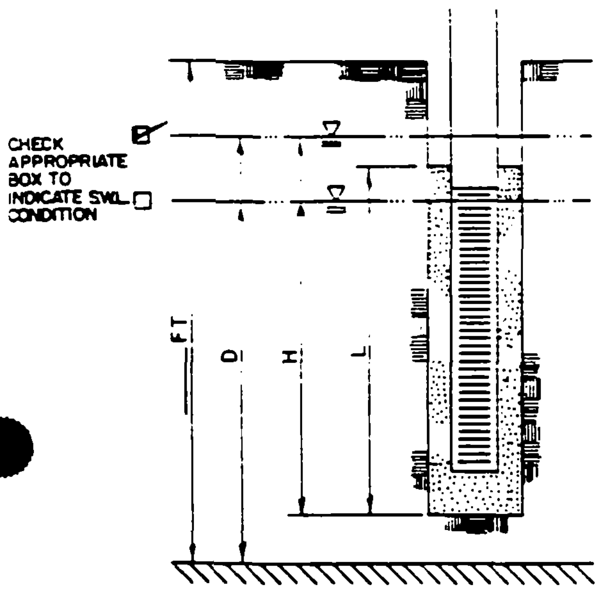
K in ft/sec = 2.36E-05

K in cm/sec = 7.20E-04

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
JOB NUMBER: 7563
WELL NUMBER: MW202

TEST BY/DATE: J Wedekind 1/17/89
CALCULATED BY/DATE: J Wedekind 1/27/89
CHECKED BY/DATE: J. Lewis 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 39.78 ft. (below top of casing) B.T.O.C.

Top ~~Filter Pack~~ Screen = 41.41 ft. B.T.O.C.

Bott. ~~Filter Pack~~ Screen = 56.46 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.46 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 15 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 16.68 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 35.22 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = [illegible], if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

K = 7.28 × 10^{-5} cm/sec

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 60.00).

A = 2.35 B = 0.54 (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 60.0).

C = NA (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.75 , T_t = 2.50 , Y_o = 1.56 , Y_t = 1.39

$$T = T_t - T_o = 105 \text{ (sec)}$$

Complete Page 5 in its entirety.

BOUWER AND RICE : GROUNDWATER HYDRAULICS

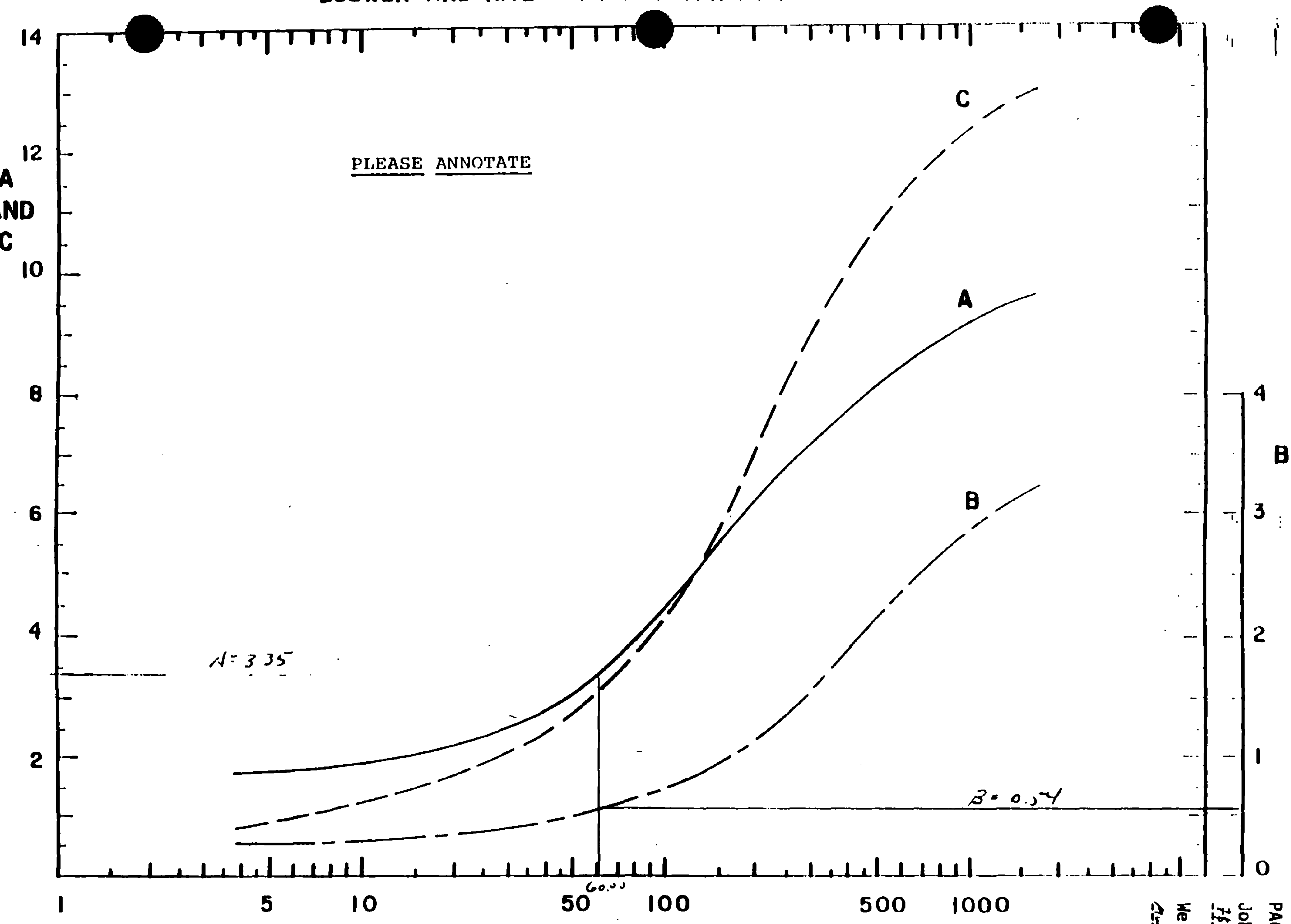


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

Well No. MW202
Job No. 7763
PAGE 3

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 / t (min.)	S.W.L. = 51.78 / y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	1.92				
	0.03	1.89				
	0.05	1.78				
	0.10	1.82				
	0.15	1.77				
	0.20	1.74				
	0.25	1.72				
	0.30	1.71				
	0.50	1.64				
x_0 –	0.75	1.56				
	1.00	1.52				
	1.25	1.49				
	1.50	1.47				
	1.75	1.45				
	2.00	1.43				
x –	2.50	1.39				
	3.00	1.36				
	4.00	1.29				
	5.00	1.24				
	6.00	1.19				
	7.00	1.15				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 3.35 (N/A if not applicable)

B (from chart) = 0.54 (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = N/A (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 35.22

D_d = ln[(D - H)/Rw] = 4.31 (must be ≤6)

H, Height of Well Below Water Table (ft) = 16.68

L, Height Through Which Water Enters Well (ft) = 15

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds (T_t - T_o) = 105

Y_o, Starting Y (ft) = 1.56

Y_t, Ending Y (ft) = 1.39

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis, Rev. 0, 2-17-89

DATE: SEPTEMBER 5, 1989
JOB NO: 7S63
WELL NO: MW202
CALC BY: J C LEWIS

INPUT DATA (FROM DATA SHEET) (if no value, leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	3.35
B (from chart) =	0.54
C (from chart) =	
D, DEPTH TO IMPERMEABLE BOUNDARY (ft) =	35.22
Dd, = ln((D-H)/Rw) =	4.31
H, HEIGHT OF WELL BELOW WATER TABLE (ft) =	16.68
L, HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	15
Rw, RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T, TIME IN SECONDS (Tt-To) =	105
Yo, STARTING Y (ft) =	1.56
Yt, ENDING Y (ft) =	1.39

CALCULATE Rc

Rc = 0.152413

CONDITION 1, PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.805075

CONDITION 2, FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.818640

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW, DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

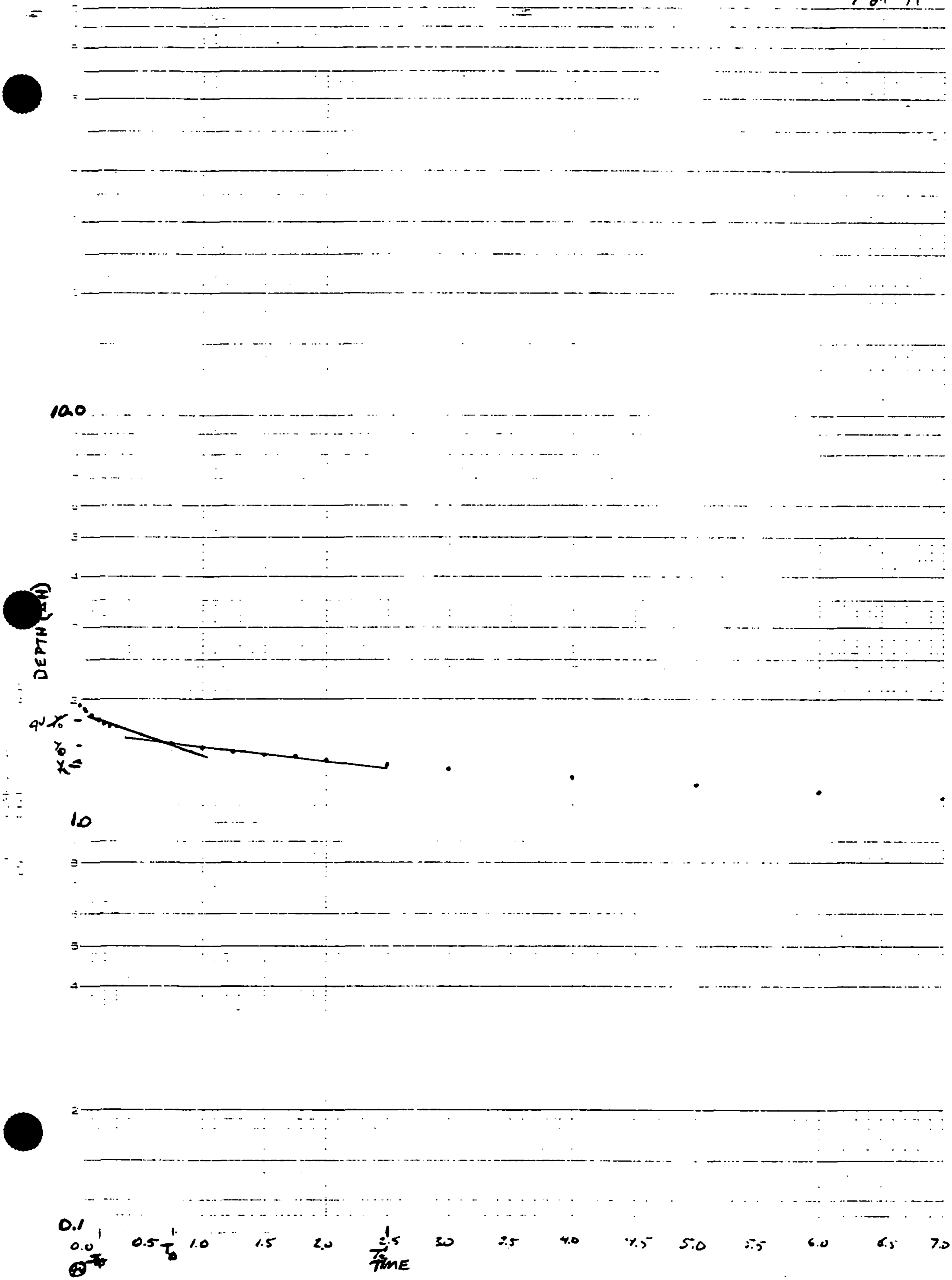
PARTIALLY PENETRATING, ln(Re/Rw) = 2.805075
FULLY PENETRATING, ln(Re/Rw) = 3.818640

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.805075

CALCULATION

K in ft/sec = 2.39E-06

K in cm/sec = 7.28E-05


100
10
0.1
DEPTH
90%
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
TIME

BORING NO. MW 402

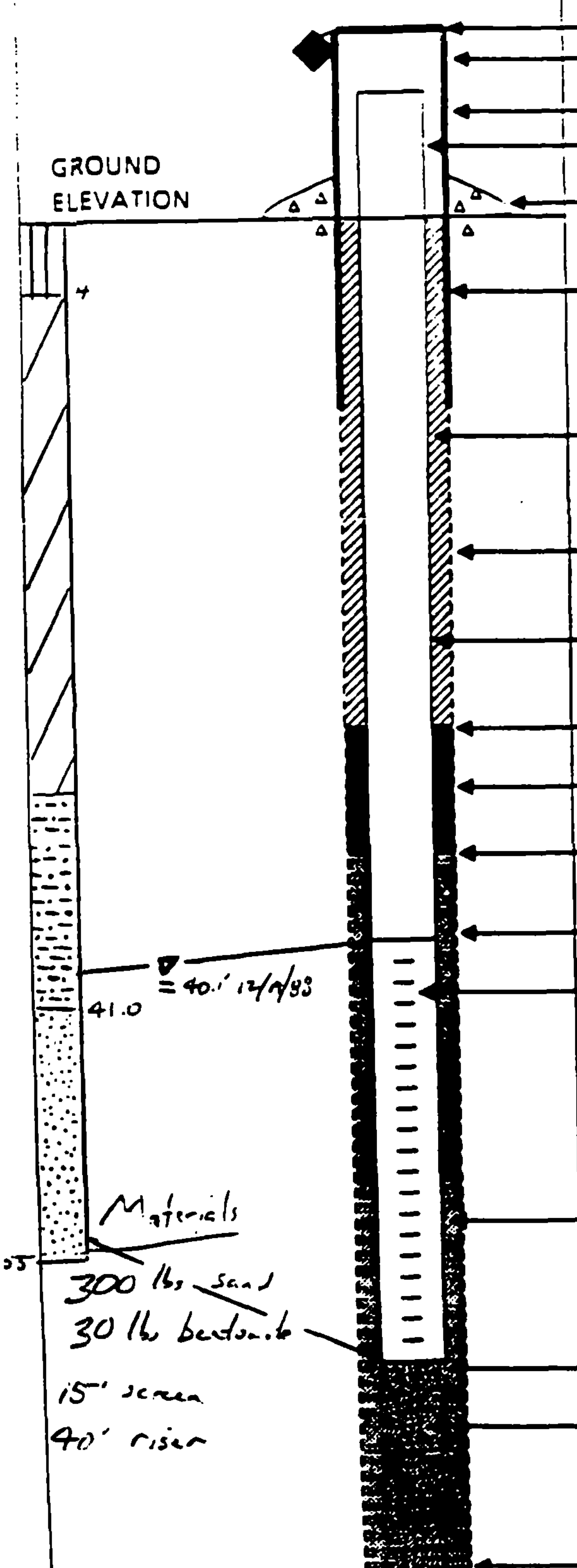
NUS CORPORATION
A Halliburton Company

MONITORING WELL SHEET

PROJECT SAFB
PROJECT NO. 3563
ELEVATION
FIELD GEOLOGIST J. Woodward

LOCATION Wichita Falls TX
BORING MW 402
DATE 11/11/88

DRILLER G. Bell
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air-lift/Bailing



ELEVATION OF TOP OF SURFACE CASING.

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: 2.63

STICK - UP RISER PIPE: 2.46

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL x 5'

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay

ELEVATION / DEPTH TOP OF SEAL: 34.0

TYPE OF SEAL: Bentonite Pellets (1/4")

DEPTH TOP OF SAND PACK: 37.0

ELEVATION / DEPTH TOP OF SCREEN: 39.0

TYPE OF SCREEN: Schedule 40 PVC

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 Silica Sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 54.0

ELEVATION / DEPTH BOTTOM OF SAND PACK: 54.6
TYPE OF BACKFILL BELOW OBSERVATION WELL: SAND

ELEVATION / DEPTH OF HOLE: 54.6

Display 1

NUS CORPORATION

WELL NO.: MW202 ELEVATION: ______ DATE: 10/17/89
STATIC WATER LEVEL ____ + CORRECTION ____ = 39.78 TIME: 1038
ELEVATION WATER ______ REFERENCE INPUT 39.78 XD: 17.16

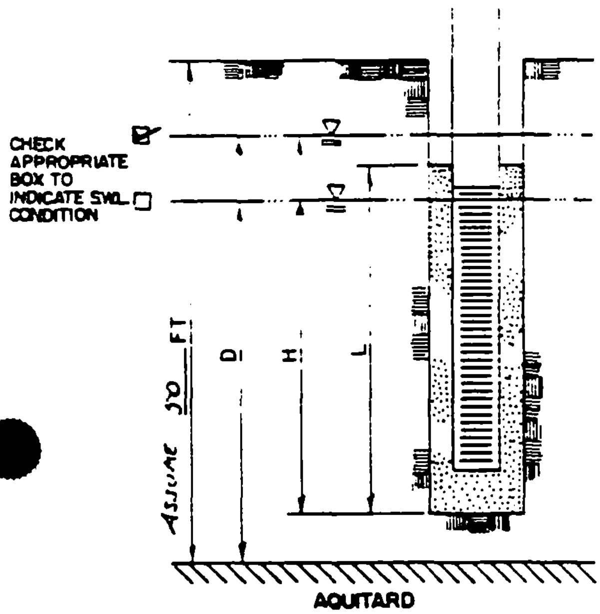
	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	41.70	
	001	0.0033	41.72	
	002	0.0067	41.57	
	003	0.0100	41.53	
	004	0.0133	41.65	
	005	0.0167	41.70	
	006	0.0200	41.60	
	007	0.0233	41.54	
	008	0.0267	41.62	
✓	009	0.0300	41.67	
	010	0.0333	41.61	
✓	011	0.0500	41.56	
	012	0.0667	41.56	
	013	0.0833	41.58	
✓	014	0.1000	41.60	
	015	0.1167	41.57	
	016	0.1333	41.54	
✓	017	0.1500	41.55	
	018	0.1667	41.55	
	019	0.1833	41.55	
✓	020	0.2000	41.52	
	021	0.2167	41.53	
	022	0.2333	41.51	
✓	023	0.2500	41.50	
	024	0.2667	41.50	
	025	0.2833	41.50	
✓	026	0.3000	41.49	
	027	0.3167	41.48	
	028	0.3333	41.50	
	029	0.4167	41.43	
✓	030	0.5000	41.42	
	031	0.5833	41.39	
	032	0.6667	41.36	
✓	033	0.7500	41.34	
	034	0.8333	41.32	
	035	0.9167	41.31	
✓	036	1.0000	41.30	
	037	1.0833	41.29	
	038	1.1667	41.28	
✓	039	1.2500	41.27	
	040	1.3333	41.26	
	041	1.4167	41.25	
✓	042	1.5000	41.25	
	043	1.5833	41.24	
	044	1.6667	41.23	

	Sample Number	Time (min)	
✓	045	1.7500	41.23
	046	1.8333	41.22
	047	1.9167	41.22
✓	048	2.0000	41.21
✓	049	2.5	41.17
✓	050	3.0	41.14
	051	3.5	41.10
✓	052	4.0	41.07
	053	4.5	41.05
✓	054	5.0	41.02
	055	5.5	40.99
✓	056	6.0	40.97
	057	6.5	40.95
✓	058	7.0	40.93
	059	7.5	40.91
	060	8.0	40.89
	061	8.5	40.87
	062	9.0	40.85
	063	9.5	40.83
	064	10.0	40.81
	065	12.0	40.77
	066	14.0	40.73
	067	16.0	40.70
	068	18.0	40.68
	069	20.0	40.65
	070	22.0	40.63
	071	24.0	4060
	072	26.0	40.58
	073	28.0	40.56
	074	30.0	40.54
	075	32.0	40.53
	076	34.0	40.51
	077	36.0	40.49
	078	38.0	40.48
	079	40.0	40.46
	080	42.0	40.45
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
JOB NUMBER: 7863
WELL NUMBER: MW301

TEST BY/DATE: J Wedekind 1/13/89
CALCULATED BY/DATE: J Wedekind 1/--/89
CHECKED BY/DATE: J. Lewis 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 9.90 ft. (below top of casing) B.T.O.C.

Top ~~Filter Pack~~ Screen = 19.04 ft. B.T.O.C.

Bott. ~~Filter Pack~~ Screen = 29.04 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.04 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 10 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 19.14 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 40.1 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = 4.43, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 9.73 \times 10^{-5} \text{ cm/sec}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

<u>CONDITION #1</u>, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 40).

A = 2.76 B = 0.45 (N/A if not applicable).

<u>CONDITION #2</u>, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = ____).

C = NA (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.50, T_t = 2.00, Y_o = 1.25, Y_t = 1.14

$$T = T_t - T_o = 90 \text{ (sec)}$$

Complete Page 5 in its entirety.

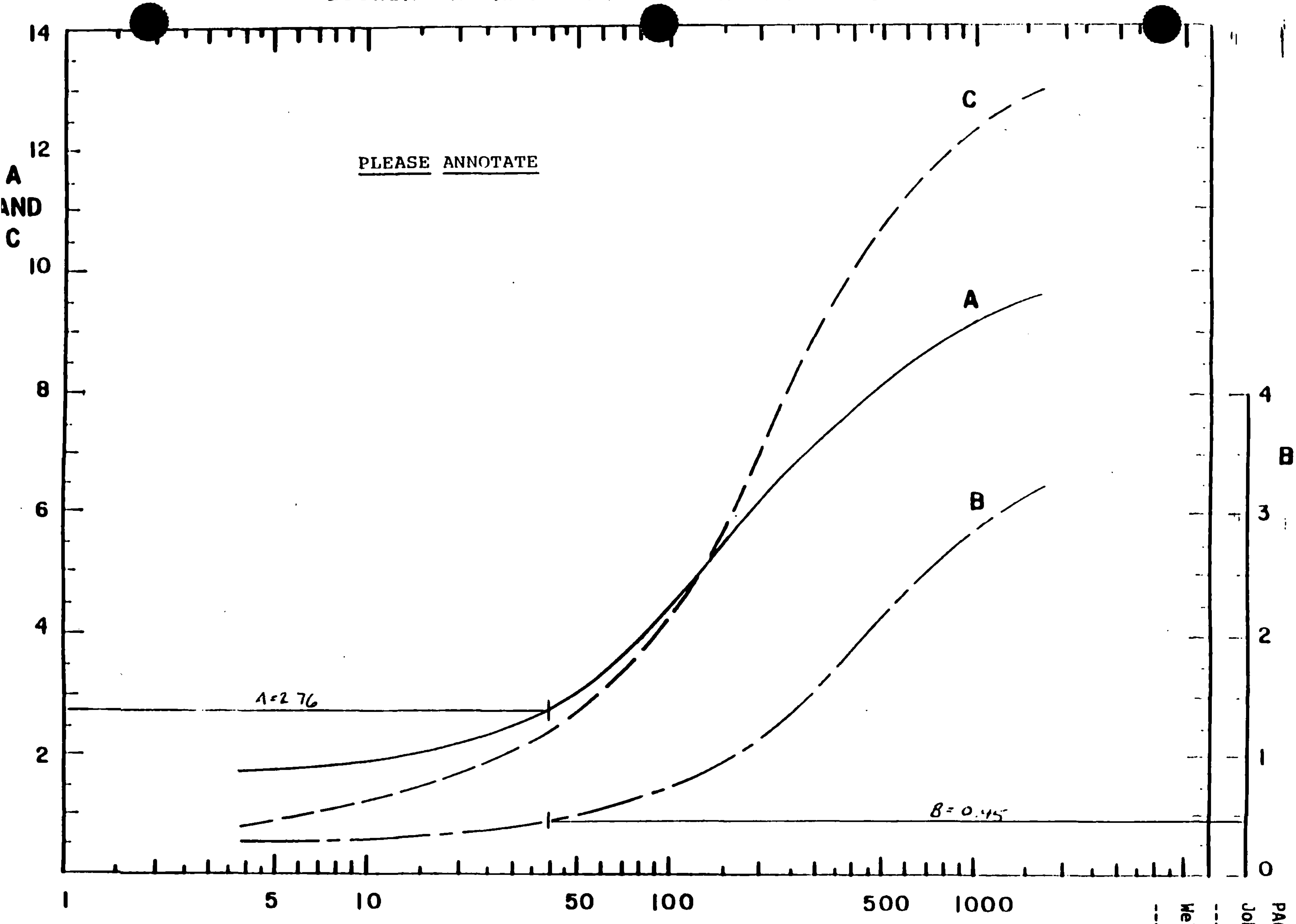


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

Well No

Job No.

PAGE 3

Job No. 7863
Well No. MW301

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 9.90 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	3.20				
	0.01	3.16				
Transducer	0.03	3.16				
Disturbed	0.05	2.53				
	0.10	1.25				
	0.15	1.30				
	0.20	1.30				
	0.25	1.29				
	0.30	1.28				
X_o	0.50	1.25				
	0.75	1.22				
	1.00	1.21				
	1.25	1.19				
	1.50	1.17				
	1.75	1.15				
X_t	2.00	1.14				
	2.50	1.11				
	3.00	1.07				
	4.00	1.01				
	5.00	0.96				
	6.00	0.91				
	7.00	0.86				
	10.00	0.74				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 2.76 (N/A if not applicable)

B (from chart) = 0.45 (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = NA (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 40.1

$D_d = \ln[(D - H)/Rw]$ = 4.43 (must be ≤ 6)

H, Height of Well Below Water Table (ft) = 19.14

L, Height Through Which Water Enters Well (ft) = 10

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds $(T_t - T_o)$ = 30

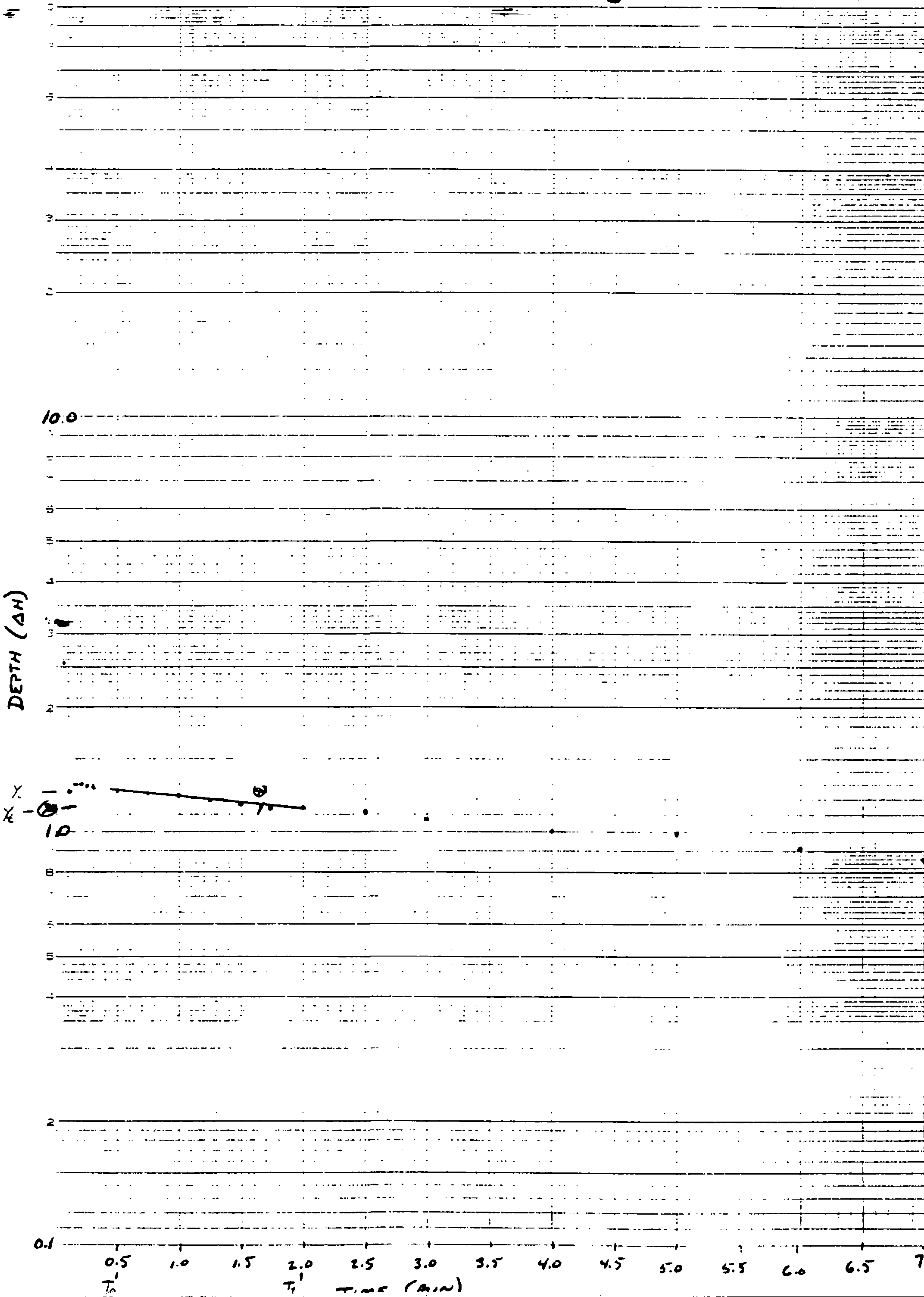
Y_o, Starting Y (ft) = 1.25

Y_t, Ending Y (ft) = 1.14

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Assumed 50' to impermeable boundary based on knowledge of site geology and the presence of discontinuous sand lenses in clay or shale.

Transducer disturbed at beginning of test.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.


DEPTH (ΔH)
10.0
1.0
0.1
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
TIME (MIN)

BORING NO.: MW301

NUS CORPORATION

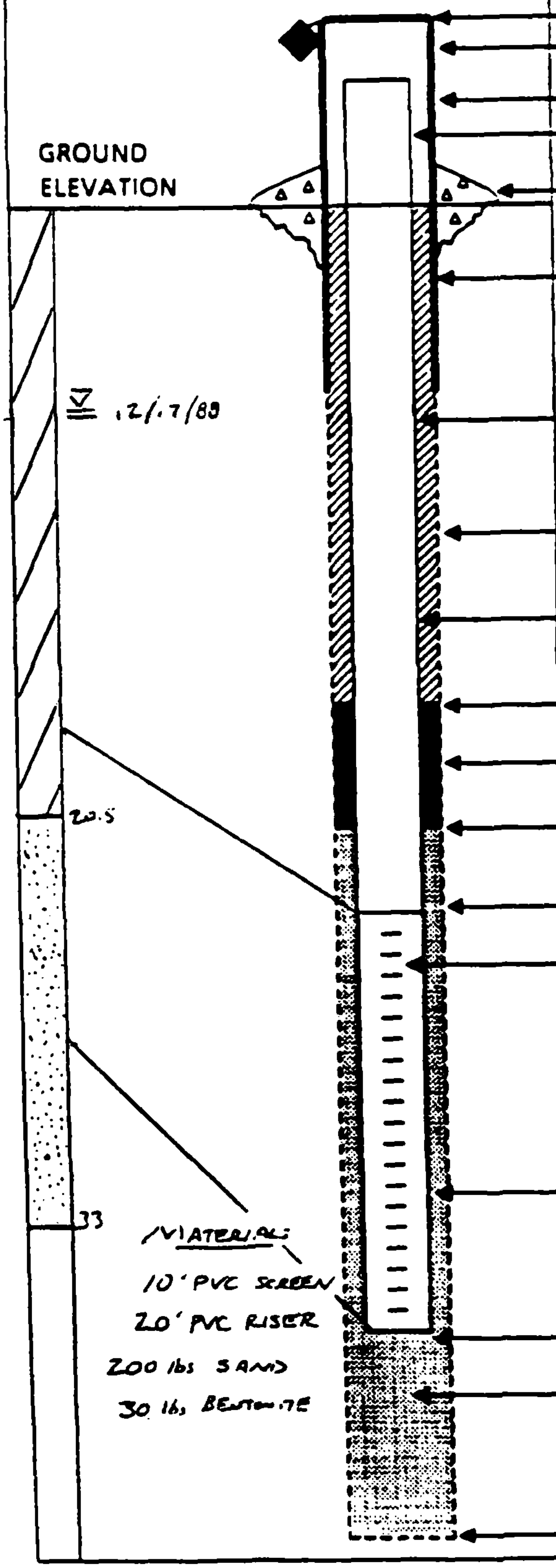
OVERBURDEN
MONITORING WELL SHEET

PROJECT SHEPPARD AFB
PROJECT NO. 7$63
ELEVATION
FIELD GEOLOGIST J. WEDEKIND

LOCATION WICHITA FALLS TX
BORING MW 301
DATE 11/13/88

DRILLER G. Pool
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD AIR LIFT

GROUND ELEVATION



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 2.18
STICK - UP RISER PIPE: 2.04
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL x 5'
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 12'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 15'
ELEVATION / DEPTH TOP OF SCREEN: 17'
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010 x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 27'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 28'
TYPE OF BACKFILL BELOW OBSERVATION WELL: BOREHOLE CAVED TO 28' - NATURAL MATERIAL -
ELEVATION / DEPTH OF HOLE: 33'

Display 2

NUS CORPORATION

WELL No.: MW301 ELEVATION: ______ DATE: 1/13/89 ~~1/15/89~~

STATIC WATER LEVEL 9.7 + CORRECTION 0.2 = 9.90 TIME: 10:5

ELEVATION WATER ______ REFERENCE INPUT 9.90 XD: 15.50

	Sample Number	Time (min)	SLUG IN/OUT	~~1/15/89~~ SLUG IN/OUT
✓	000	0.0000	13.10	
	001	0.0033	13.11	
	002	0.0067	13.08	
	003	0.0100	13.04	
✓	004	0.0133	13.06	
				NOTE: Transducer was disturbed briefly while bailer was pulled out
	005	0.0167	13.08	
#02	006	0.0200	13.08	
✓	007	0.0233	13.06	
	008	0.0267	13.05	
	009	0.0300	13.06	
	010	0.0333	13.08	
✓	011	0.0500	12.43	
	012	0.0667	11.07	
	013	0.0833	11.11	
✓	014	0.1000	11.15	
	015	0.1167	11.17	
	016	0.1333	11.19	
✓	017	0.1500	11.20	
	018	0.1667	11.20	
	019	0.1833	11.20	
✓	020	0.2000	11.20	
	021	0.2167	11.19	
	022	0.2333	11.19	
✓	023	0.2500	11.19	
	024	0.2667	11.19	
	025	0.2833	11.18	
✓	026	0.3000	11.18	
	027	0.3167	11.18	
	028	0.3333	11.17	
	029	0.4167	11.16	
✓	030	0.5000	11.15	
	031	0.5833	11.14	
	032	0.6667	11.13	
✓	033	0.7500	11.12	
	034	0.8333	11.12	
	035	0.9167	11.11	
✓	036	1.0000	11.11	
	037	1.0833	11.10	
	038	1.1667	11.09	
✓	039	1.2500	11.09	
	040	1.3333	11.08	
	041	1.4167	11.07	
✓	042	1.5000	11.07	
	043	1.5833	11.06	
	044	1.6667	11.05	

	Sample Number	Time (min)	
✓	045	1.7500	11.05
	046	1.8333	11.05
	047	1.9167	11.05
✓	048	2.0000	11.04
✓	049	2.5	11.01
✓	050	3.0	10.97
	051	3.5	10.94
✓	052	4.0	10.91
	053	4.5	10.89
✓	054	5.0	10.86
	055	5.5	10.84
✓	056	6.0	10.81
	057	6.5	10.79
✓	058	7.0	10.76
	059	7.5	10.75
	060	8.0	10.72
	061	8.5	10.70
	062	9.0	10.68
	063	9.5	10.66
✓	064	10.0	10.64
	065	12.0	10.57
	066	14.0	10.50
	067	16.0	10.44
	068	18.0	10.39
	069	20.0	10.34
	070	22.0	10.29
	071	24.0	10.26
	072	26.0	10.21
	073	28.0	10.18
	074	30.0	10.15
	075	32.0	10.12
	076	34.0	10.10
	077	36.0	10.07
	078	38.0	10.05
	079	40.0	
	080	42.0	
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis, Rev. 0, 2-17-89

DATE: SEPTEMBER 5, 1989
JOB NO: 7563
WELL NO: MW301
CALC BY: J C LEWIS

INPUT DATA (FROM DATA SHEET) (if no value, leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	2.76
B (from chart) =	0.45
C (from chart) =	
D, DEPTH TO IMPERMEABLE BOUNDARY (ft) =	40.1
Dd, = ln((D-H)/Rw) =	4.43
H, HEIGHT OF WELL BELOW WATER TABLE (ft) =	19.14
L, HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	10
Rw, RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T, TIME IN SECONDS (Tt-To) =	90
Yo, STARTING Y (ft) =	1.25
Yt, ENDING Y (ft) =	1.14

CALCULATE Rc

Rc = 0.152413

CONDITION 1, PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.685239

CONDITION 2, FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.943704

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW,
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING, ln(Re/Rw) = 2.685239
FULLY PENETRATING, ln(Re/Rw) = 3.943704

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.685239

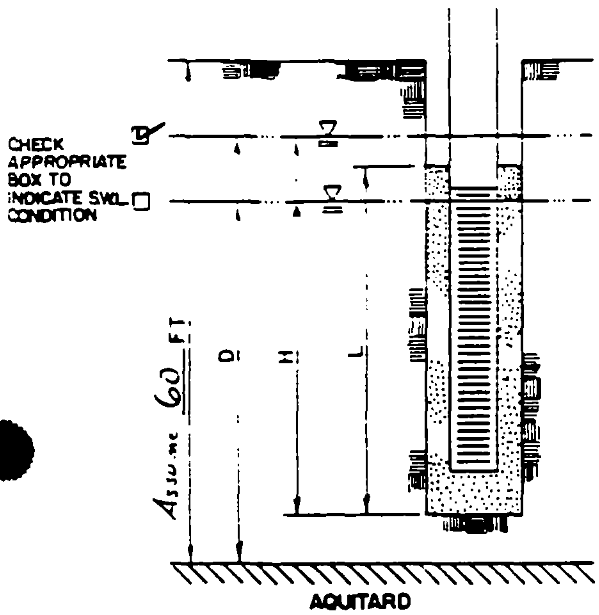
CALCULATION

K in ft/sec = 3.19E-06

K in cm/sec = 9.73E-05

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	TEST BY/DATE:	P. Pogue 1/5/89
JOB NUMBER:	7563	CALCULATED BY/DATE:	J. Wedeking 3/22/89
WELL NUMBER:	MW302	CHECKED BY/DATE:	J. Mehlhaff 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 12.19 ft. (below top of casing) B.T.O.C.

Top ~~Filter Pack~~ Screen = 30.4 ft. B.T.O.C.

Bott. ~~Filter Pack~~ Screen = 40.4 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.4 ft. above/below grade

Filter Pack Porosity = 0.3

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

Water is considered to enter the well only through the screened portion of the well rather than through the entire filter pack.

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 10 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 33.21 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 47.81 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = 4.07, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 6.88 \times 10^{-4}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 84).

A = 4.13 B = 0.7 (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = ____).

C = NA (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.41 , T_t = 1.50 , Y_o = 3.66 , Y_t = 2.20

$$T = T_t - T_o = \underline{65.4} \text{ (sec)}$$

Complete Page 5 in its entirety.

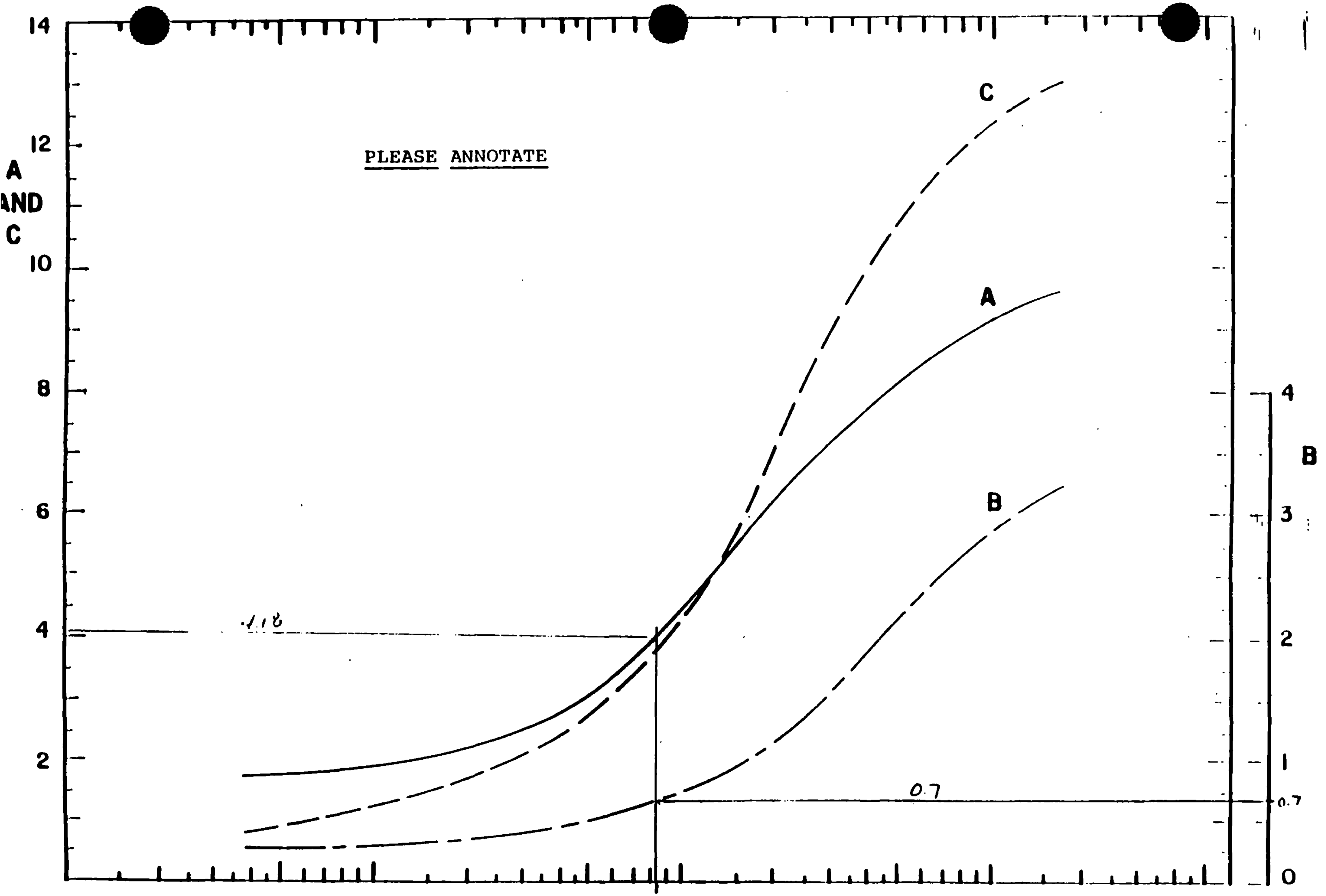


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

Well No

Job No.

PAGE 3

Job No. 7163
Well No. MW-30R

PLOT y versus t (from field data, attached at back):

where:

- **t = time measured in field during slug test**
- **y = depth to static water table minus depth to falling water level (for slug injection)**

or

- **y = depth to rising water level minus depth to static water table (for slug removal)**

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0	S.W.L. = 12.6	t (min.)	y (feet)	t (min.)	y (feet)
	t (min.)	y (feet)				
	0.00	4.52				
	0.01	4.49				
	0.05	4.41				
	0.10	4.28				
	0.15	4.18				
	0.20	4.07				
	0.25	3.96				
	0.30	3.87				
X_0 -	0.41	3.66				
	0.50	3.50				
	0.75	3.10				
	1.00	2.75				
	1.25	2.45				
X_t -	1.50	2.20				
	1.75	1.96				
	2.00	1.75				
	2.50	1.42				
	3.00	1.16				
	4.00	0.78				
	5.00	0.55				
	6.00	0.39				
	7.00	0.28				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 4.18 (N/A if not applicable)

B (from chart) = 0.7 (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = NA (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 47.81

$D_d = \ln[(D - H)/Rw]$ = 4.07 (must be ≤ 6)

H, Height of Well Below Water Table (ft) = 33.21

L, Height Through Which Water Enters Well (ft) = 10

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds ($T_t - T_0$) = 65.4

Y_0, Starting Y (ft) = 3.66

Y_t, Ending Y (ft) = 2.2

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

SLUG-IN Poured in 5 gallons of potable water.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

BORING NO.: MW302

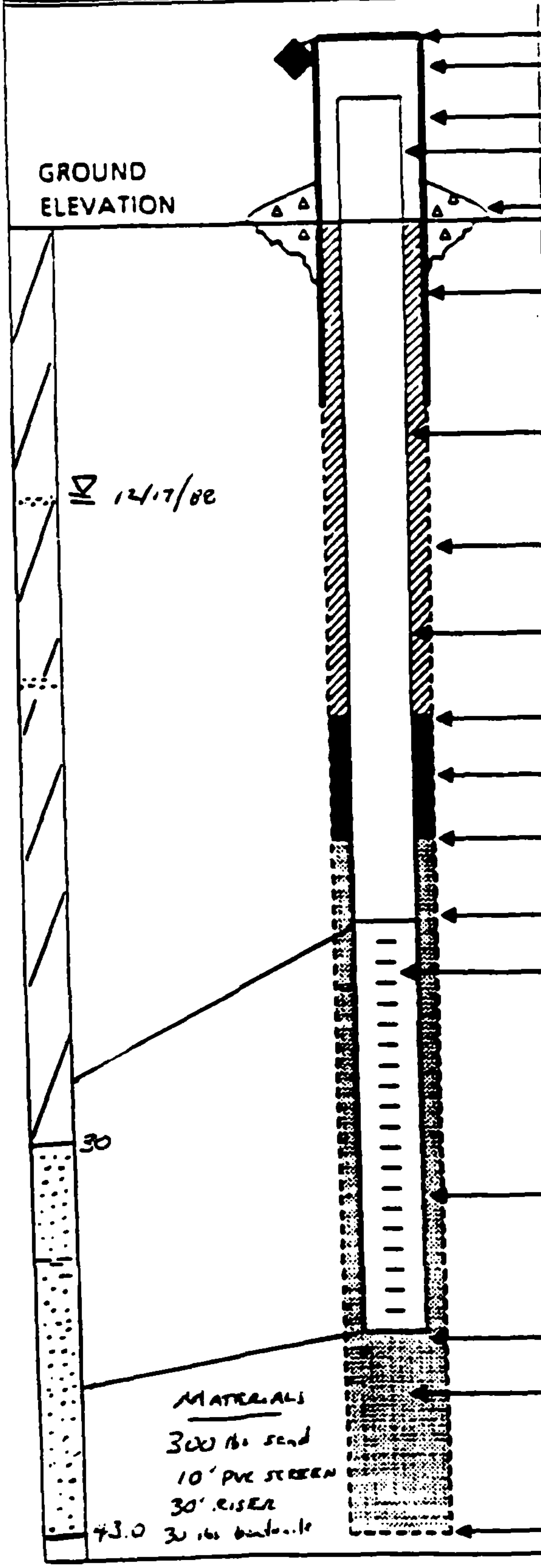
NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

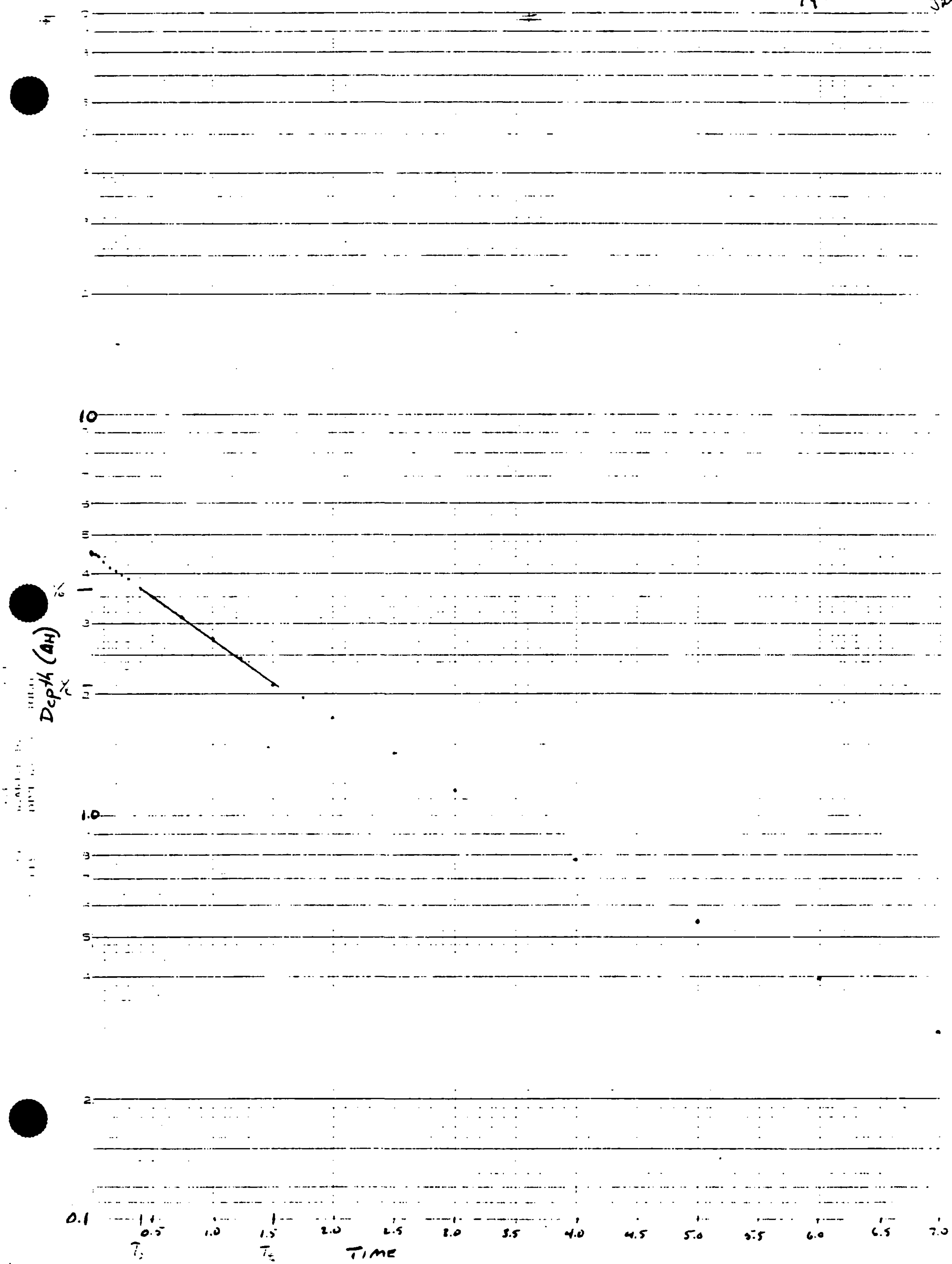
PROJECT: SHEPPARD AFB
PROJECT NO.: 7$63
ELEVATION: ____
FIELD GEOLOGIST: J WEDEKIND

LOCATION: WICHITA FALLS TX
BORING: MW.302
DATE: 11/13/88

DRILLER: G. POOL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT



ELEVATION OF TOP OF SURFACE CASING: ____
ELEVATION OF TOP OF RISER PIPE: ____
STICK-UP TOP OF SURFACE CASING: 2.83
STICK-UP RISER PIPE: 2.40
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL - 5'
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 23
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 26
ELEVATION / DEPTH TOP OF SCREEN: 28
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010" x 10'
I.D. OF SCREEN: 2" x 10'
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 38
ELEVATION / DEPTH BOTTOM OF SAND PACK: 43
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND
ELEVATION / DEPTH OF HOLE: 43.0



10
1.0
0.1
Depth (ΔH) %
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
TIME

Display 4

NUS CORPORATION

WELL NO.: MW302 ELEVATION: ______ DATE: 1/15/89

STATIC WATER LEVEL 12.09 + CORRECTION x 0.1 = 12.19 TIME 1420

ELEVATION WATER ______ REFERENCE INPUT 12.19 XD: 28.41

	Sample Number	Time (min)	SLUG (IN)/OUT	SLUG IN/OUT
✓	000	0.0000	7.67	
	001	0.0033	7.67	
	002	0.0067	7.69	
	003	0.0100	7.70	
✓	004	0.0133	7.70	
	005	0.0167	7.70	
	006	0.0200	7.72	
	007	0.0233	7.72	
	008	0.0267	7.74	
✓	009	0.0300	7.75	
	010	0.0333	7.75	
✓	011	0.0500	7.78	
	012	0.0667	7.83	
	013	0.0833	7.86	
✓	014	0.1000	7.91	
	015	0.1167	7.94	
	016	0.1333	7.97	
✓	017	0.1500	8.01	
	018	0.1667	8.05	
	019	0.1833	8.09	
✓	020	0.2000	8.12	
	021	0.2167	8.15	
	022	0.2333	8.18	
✓	023	0.2500	8.23	
	024	0.2667	8.26	
	025	0.2833	8.29	
✓	026	0.3000	8.32	
	027	0.3167	8.36	
	028	0.3333	8.39	
✓	029	0.4167	8.53	
✓	030	0.5000	8.69	
	031	0.5833	8.83	
	032	0.6667	8.96	
✓	033	0.7500	9.09	
	034	0.8333	9.21	
	035	0.9167	9.33	
✓	036	1.0000	9.44	
	037	1.0833	9.55	
	038	1.1667	9.64	
✓	039	1.2500	9.74	
	040	1.3333	9.82	
	041	1.4167	9.91	
✓	042	1.5000	9.99	
	043	1.5833	10.09	
	044	1.6667	10.15	

	Sample Number	Time (min)	
✓	045	1.7500	10.23
	046	1.8333	10.29
	047	1.9167	10.37
✓	048	2.0000	10.44
✓	049	2.5	10.77
✓	050	3.0	11.03
✓	051	3.5	11.23
✓	052	4.0	11.41
	053	4.5	11.53
✓	054	5.0	11.64
	055	5.5	11.74
✓	056	6.0	11.80
	057	6.5	11.87
✓	058	7.0	11.91
	059	7.5	11.96
	060	8.0	11.99
	061	8.5	12.01
	062	9.0	12.04
	063	9.5	12.07
	064	10.0	12.09
	065	12.0	12.14
	066	14.0	12.17
	067	16.0	12.19
	068	18.0	12.20
	069	20.0	12.20
	070	22.0	12.22
	071	24.0	12.22
	072	26.0	12.23
	073	28.0	12.23
	074	30.0	12.25
	075	32.0	12.25
	076	34.0	12.25
	077	36.0	12.25
	078	38.0	12.25
	079	40.0	12.25
	080	42.0	
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

p. 9 of 11

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis, Rev. 0, 2-17-89

DATE: Sept. 5, 1989
JOB NO: 7s63
WELL NO: MW302
CALC BY: J WEDEKIND/J MATLOCK

INPUT DATA (FROM DATA SHEET) (if no value, leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	4.18
B (from chart) =	0.7
C (from chart) =	0
D, DEPTH TO IMPERMEABLE BOUNDARY (ft) =	47.81
Do, = ln((D-H)/Rw) =	4.07
H, HEIGHT OF WELL BELOW WATER TABLE (ft) =	33.21
L, HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	10
Rw, RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T, TIME IN SECONDS (Tt-To) =	65.4
Yo, STARTING Y (ft) =	3.66
Yt, ENDING Y (ft) =	2.2

Changed from previous calculation JM

CALCULATE Rc

Rc = 0.152413

CONDITION 1, PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.495550

CONDITION 2, FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 4.444677

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW,
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING, ln(Re/Rw) = 2.495550
FULLY PENETRATING, ln(Re/Rw) = 4.444677

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.49555

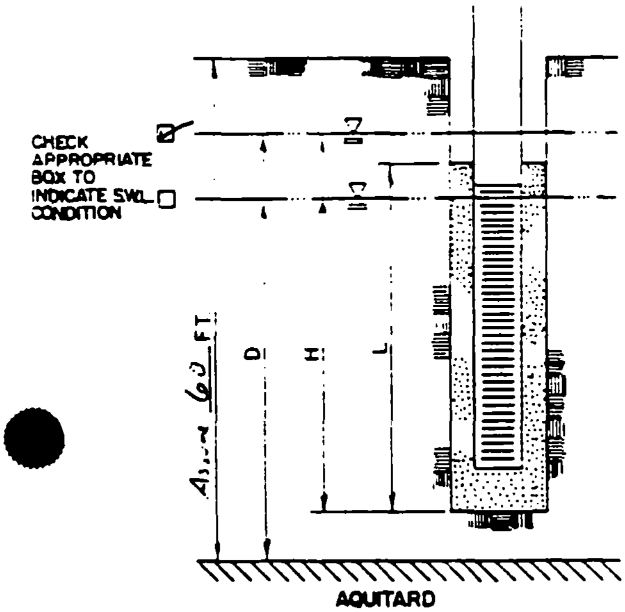
CALCULATION

K in ft/sec = 2.26E-05

K in cm/sec = 6.88E-04

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	**TEST BY/DATE:**	R. Pruve 1/13/89
JOB NUMBER:	7563	**CALCULATED BY/DATE:**	J. Wedeking 3/24/89
WELL NUMBER:	MW302	**CHECKED BY/DATE:**	J. Lewis 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 12.40 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 30.40 ft. B.T.O.C.

Bott. Filter Pack = 40.40 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.40 ft. above/below grade

Filter Pack Porosity = 0.3

Circle type of well: fully partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 10 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 28.00 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 47.6 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = 4.36, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 8.35 \times 10^{-4}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

<u>CONDITION #1</u>, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 40).

A = 2.77 B = 0.44 (N/A if not applicable).

<u>CONDITION #2</u>, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = ____).

C = NA (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.41 , T_t = 1.75 , Y_o = 2.04 , Y_t = 1.05

$$T = T_t - T_o = 80.4 \text{ (sec)}$$

Complete Page 5 in its entirety.

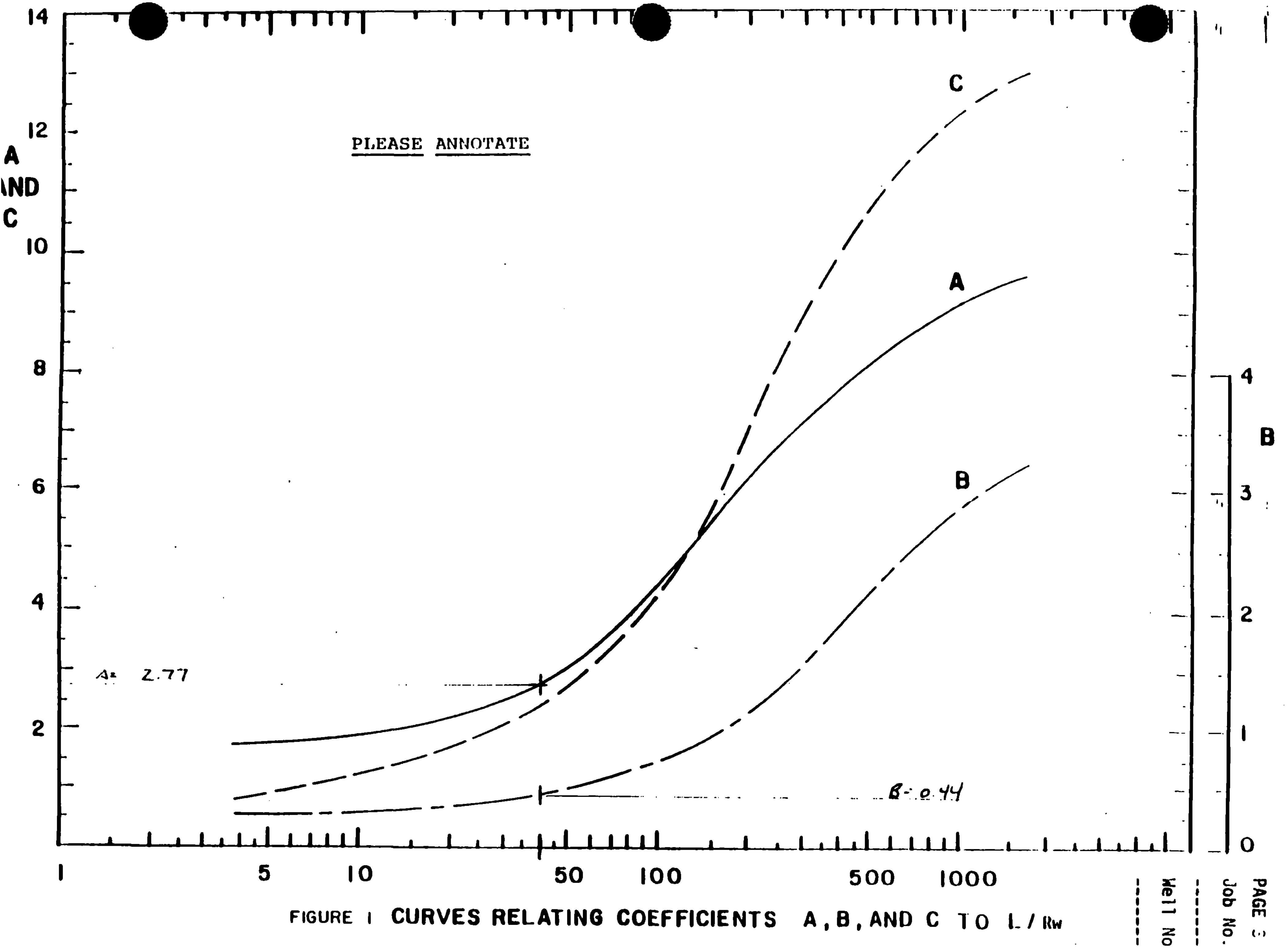


FIGURE I CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 12.40 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	2.65				
	0.01	2.64				
	0.05	2.57				
	0.10	2.49				
	0.15	2.41				
	0.20	2.33				
	0.25	2.25				
	0.30	2.18				
X_o –	0.41	2.04				
	0.50	1.95				
	0.75	1.70				
	1.00	1.50				
	1.25	1.33				
	1.50	1.18				
X_t –	1.75	1.05				
	2.00	0.94				
	2.50	0.75				
	3.00	0.61				
	4.00	0.42				
	5.00	0.29				
	6.00	0.21				
	7.00	0.16				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 2.77 (N/A if not applicable)

B (from chart) = 0.44 (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = NA (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 47.6

$D_d = \ln[(D - H)/Rw]$ = 4.36 (must be ≤ 6)

H, Height of Well Below Water Table (ft) = 28

L, Height Through Which Water Enters Well (ft) = 10

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds ($T_t - T_o$) = 80.4

Y_o, Starting Y (ft) = 2.04

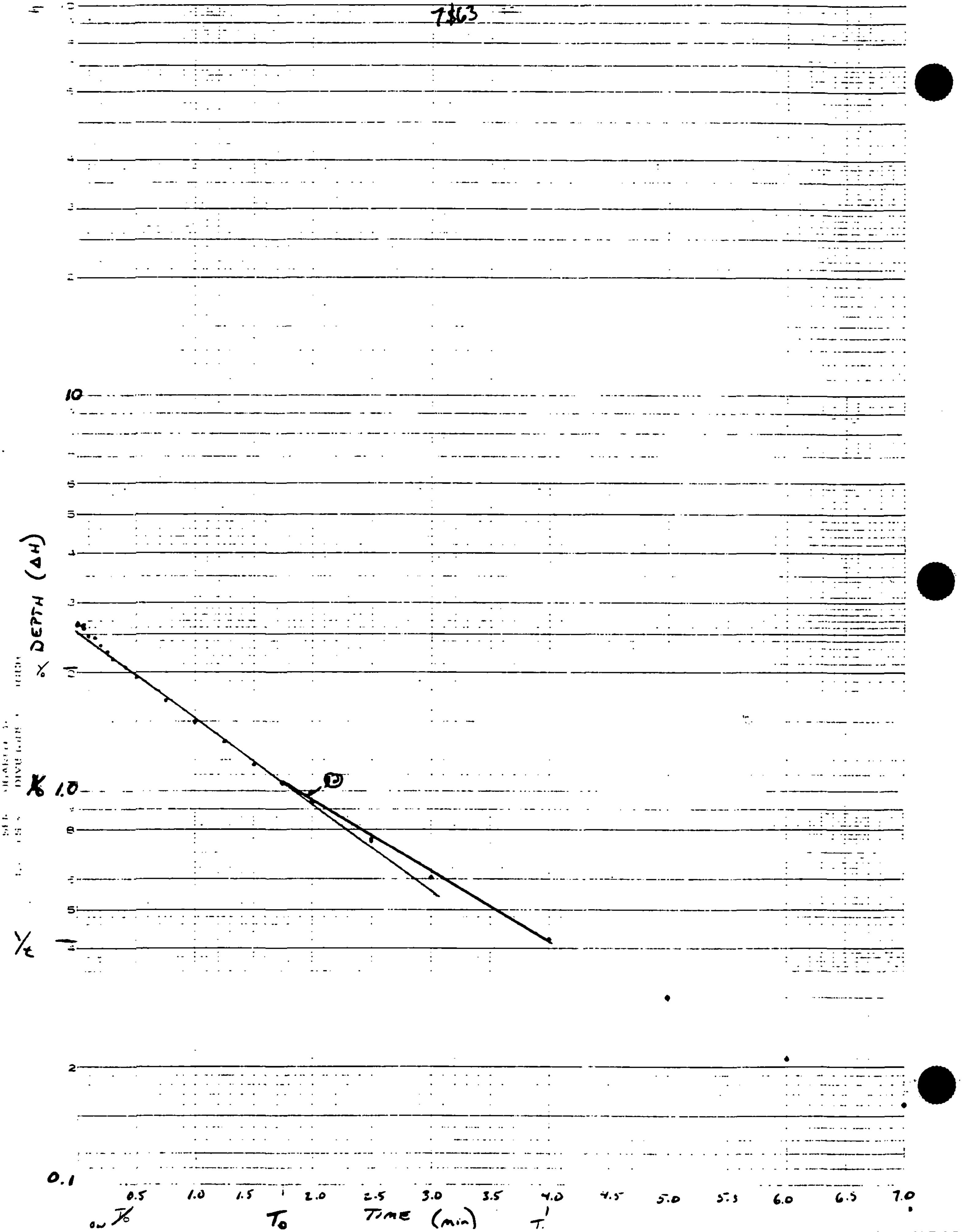
Y_t, Ending Y (ft) = 1.05

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Assumed that depth to impermeable boundary is ~60' based upon knowledge of site geology. Specifically, no sand unit was thicker than 30'.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

MW302 - SLUG OUT

7363



BORING NO.: MW302

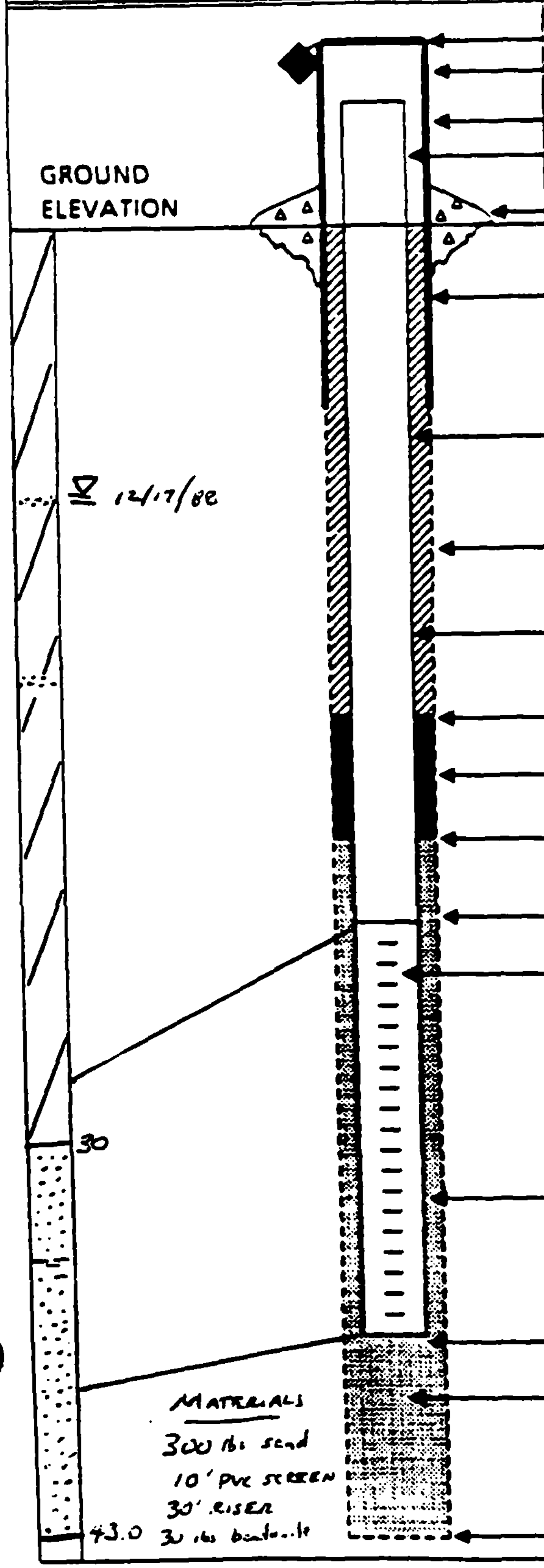
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
PROJECT NO.: 7$63
ELEVATION:
FIELD GEOLOGIST: J. WEDEKIND

LOCATION: WICHITA FALLS, TX
BORING: MW 302
DATE: 11/13/88

DRILLER: G. POOL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT



ELEVATION OF TOP OF SURFACE CASING: ______

ELEVATION OF TOP OF RISER PIPE: ______

STICK - UP TOP OF SURFACE CASING: 2.83

STICK - UP RISER PIPE: 2.40

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL ~5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 23

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 26

ELEVATION / DEPTH TOP OF SCREEN: 28

TYPE OF SCREEN: SCHEDULE 40 PVC

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2" x 10'

TYPE OF SAND PACK: 20-40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 38

ELEVATION / DEPTH BOTTOM OF SAND PACK: 43

TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND

ELEVATION / DEPTH OF HOLE: 43.0

Display 1

NUS CORPORATION

WELL No.: MW 302 ELEVATION: ______ DATE: 1/13/89

STATIC WATER LEVEL 12.2 + CORRECTION 0.2 = 12.4 TIME: 9:08

ELEVATION WATER ______ REFERENCE INPUT 12.40 XD: 22.45

22.47 + 12.4 = 34.87

	Sample Number	Time (min)	SLUG IN/OUT		SLUG IN/OUT
✓	000	0.0000	15.05	Test 2:	7.67
	001	0.0033	15.05	SWL = 12.09	7.67
	002	0.0067	15.04	+ 0.1 corr.	7.69
	003	0.0100	15.04	Ref. Input = 12.19	7.70
✓	004	0.0133	15.04	XD = 28.41	7.70
				Date:	~~7.70~~
	005	0.0167	15.03	Time: 1420	7.70
	006	0.0200	15.02	Display 4	7.72
	007	0.0233	15.02		7.72
	008	0.0267	15.01		7.74
	009	0.0300	15.01		7.75
	010	0.0333	15.00		7.75
✓	011	0.0500	14.97		7.78
	012	0.0667	14.95		7.83
	013	0.0833	14.92		7.86
✓	014	0.1000	14.89		7.91
	015	0.1167	14.86		7.94
	016	0.1333	14.83		7.97
✓	017	0.1500	14.81		8.01
	018	0.1667	14.78		8.05
	019	0.1833	14.75		8.09
✓	020	0.2000	14.73		8.12
	021	0.2167	14.70		8.15
	022	0.2333	14.68		8.18
✓	023	0.2500	14.65		8.23
	024	0.2667	14.63		8.26
	025	0.2833	14.61		8.29
✓	026	0.3000	14.58		8.32
	027	0.3167	14.56		8.36
	028	0.3333	14.55		8.39
✓	029	0.4167	14.44		8.53
✓	030	0.5000	14.35		8.69
	031	0.5833	14.26		8.83
	032	0.6667	14.18		8.96
✓	033	0.7500	14.10		9.09
	034	0.8333	14.03		9.21
	035	0.9167	13.97		9.33
✓	036	1.0000	13.90		9.44
	037	1.0833	13.84		9.55
	038	1.1667	13.78		9.64
✓	039	1.2500	13.73		9.74
	040	1.3333	13.68		9.82
	041	1.4167	13.63		9.91
✓	042	1.5000	13.58		9.99
	043	1.5833	13.53		10.09
	044	1.6667	13.49		10.15

	Sample Number	Time (min)			
✓	045	1.7500	13.45	10.23	
	046	1.8333	13.41	10.29	
	047	1.9167	13.37	10.37	
✓	048	2.0000	13.34	10.44	
✓	049	2.5	13.15	10.77	
✓	050	3.0	13.01	11.03	
✓	051	3.5	12.90	11.23	
✓	052	4.0	12.82	11.41	
	053	4.5	12.75	11.53	
✓	054	5.0	12.69	11.64	
	055	5.5	12.65	11.74	
✓	056	6.0	12.61	11.80	
	057	6.5	12.58	11.87	
✓	058	7.0	12.56	11.91	
	059	7.5	12.54	11.96	
	060	8.0	12.52	11.99	
	061	8.5	12.51	12.01	
	062	9.0	12.49	12.04	
	063	9.5	12.48	12.07	
	064	10.0	12.48	12.09	
	065	12.0	12.45	12.14	
	066	14.0	12.43	12.17	
	067	16.0	12.42	12.19	← R. Input
	068	18.0	12.41	12.20	
	069	20.0	12.41	12.20	
	070	22.0	12.41	12.22	
	071	24.0	12.40	12.22	
	072	26.0	12.40	12.23	
	073	28.0	12.40	12.23	
	074	30.0	12.40	12.25	
	075	32.0	12.40	12.25	
	076	34.0	12.40	12.25	
	077	36.0		12.25	
	078	38.0		12.25	
	079	40.0		12.25	
	080	42.0			
	081	44.0			
	082	46.0			
	083	48.0			
	084	50.0			
	085	52.0			
	086	54.0			
	087	56.0			
	088	58.0			
	089	60.0			

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis, Rev. 0, 2-17-89

DATE: SEPTEMBER 5, 1989
JOB NO: 7S63
WELL NO: MW302
CALC BY: J C LEWIS

INPUT DATA (FROM DATA SHEET) (if no value, leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	2.77
B (from chart) =	0.44
C (from chart) =	
D, DEPTH TO IMPERMEABLE BOUNDARY (ft) =	47.6
Dd, = ln((D-H)/Rw) =	4.36
H, HEIGHT OF WELL BELOW WATER TABLE (ft) =	28
L, HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	10
Rw, RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T, TIME IN SECONDS (Tt-To) =	80.4
Yo, STARTING Y (ft) =	2.04
Yt, ENDING Y (ft) =	1.05

CALCULATE Rc

Rc = 0.152413

CONDITION 1, PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.854410

CONDITION 2, FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 4.289544

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW,
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING, ln(Re/Rw) = 2.854410
FULLY PENETRATING, ln(Re/Rw) = 4.289544

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.85441

CALCULATION

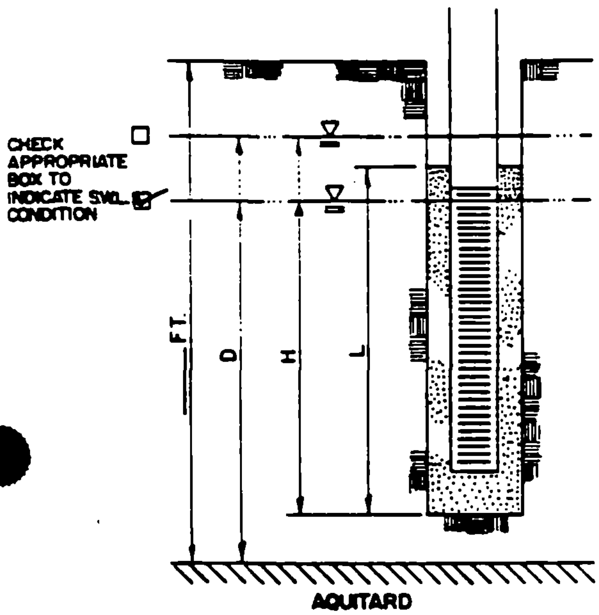
K in ft/sec = 2.74E-05

K in cm/sec = 8.35E-04

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
JOB NUMBER: 7463
WELL NUMBER: MW30B

TEST BY/DATE: P. Pogue 1/15/89
CALCULATED BY/DATE: J. [illegible] 2/3/89
CHECKED BY/DATE: J Mattock 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 45.93 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 42.43 ft. B.T.O.C.

Bott. Filter Pack = 54.43 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.43 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 8.5 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 8.5 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 8.5 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = 2 = N/ , if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

K = 6.36 × 10^-5

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 34).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 34).

C = 2.25 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_0, Y_0 (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_0 = 1.00 , T_t = 5.0 , Y_0 = 0.85 , Y_t = 0.74

$$T = T_t - T_0 = 240 \text{ (sec)}$$

Complete Page 5 in its entirety.

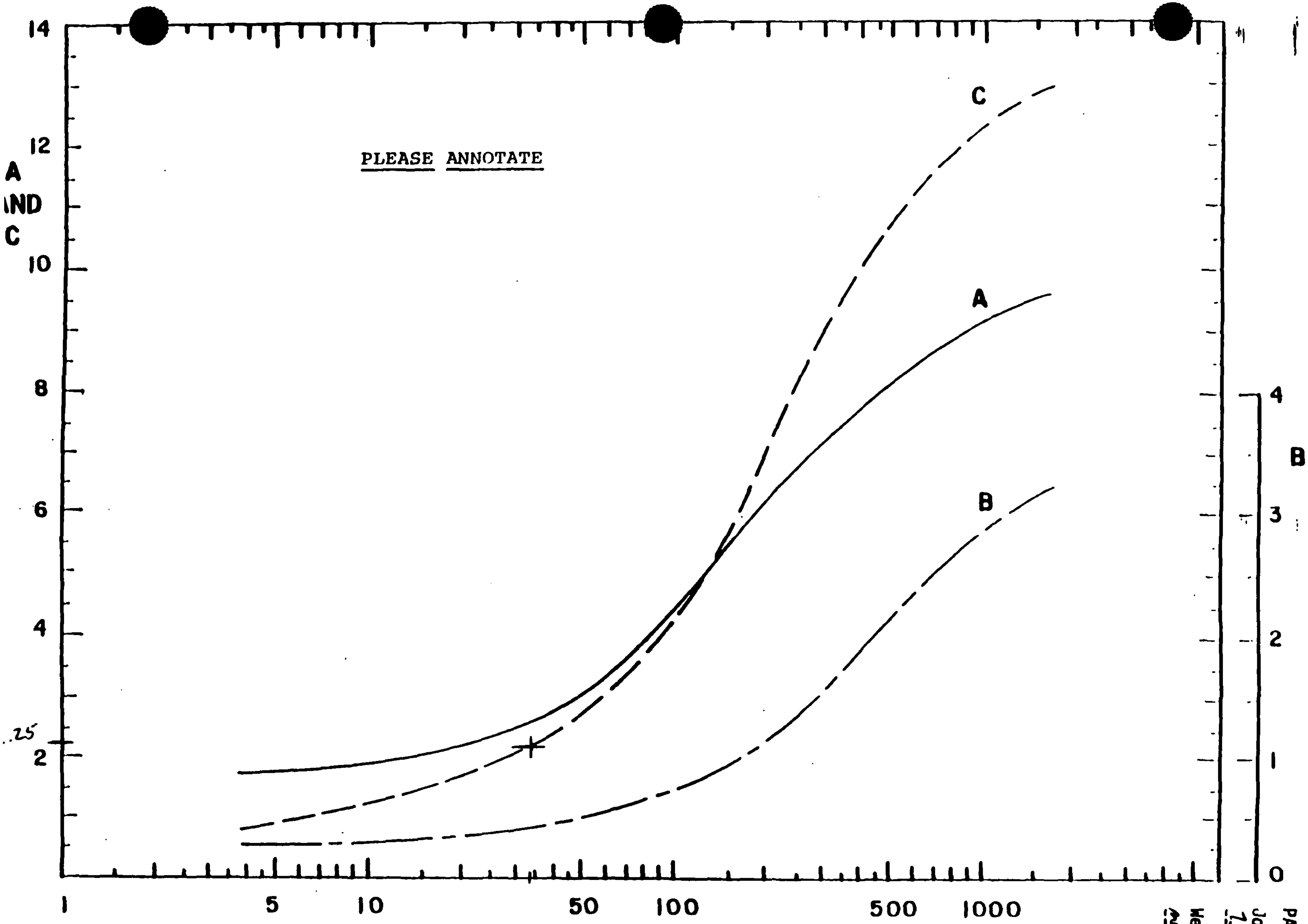


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

PAGE
Job No.
Well No

Job No. 7865
Well No. MW302

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 45.13 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	0.84	10.0	0.71		
	0.03	0.85	12.0	0.71		
	0.05	0.85	14.0	0.70		
	0.10	0.85				
	0.15	0.85				
	0.20	0.86				
	0.25	0.86				
	0.30	0.86				
	0.50	0.86				
	0.75	0.86				
X_o —	1.00	0.85				
	1.25	0.85				
	1.50	0.84				
	1.75	0.82				
	2.00	0.82				
	2.5	0.82				
	3.0	0.82				
	4.0	0.76				
X_t —	5.0	0.74				
	6.0	0.74				
	7.0	0.73				
	8.0	0.71				
	9.0	0.71				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)
B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 2.25 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 8.5
D_d = ln[(D - H)/Rw] = D=H (must be ≤6)
H, Height of Well Below Water Table (ft) = 8.5
L, Height Through Which Water Enters Well (ft) = 8.5
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 240
Y_o, Starting Y (ft) = 0.85
Y_t, Ending Y (ft) = 0.74

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Used bottom of sand pack as depth to impermeable boundary due to apparently low permeability.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7S63
WELL NO: MW303
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	2.25
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	8.5
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	8.5
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	8.5
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	240
Yo. STARTING Y (ft) =	0.85
Yt. ENDING Y (ft) =	0.74

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.205782

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.644713

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.205782
FULLY PENETRATING. ln(Re/Rw) = 2.644713

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.644713

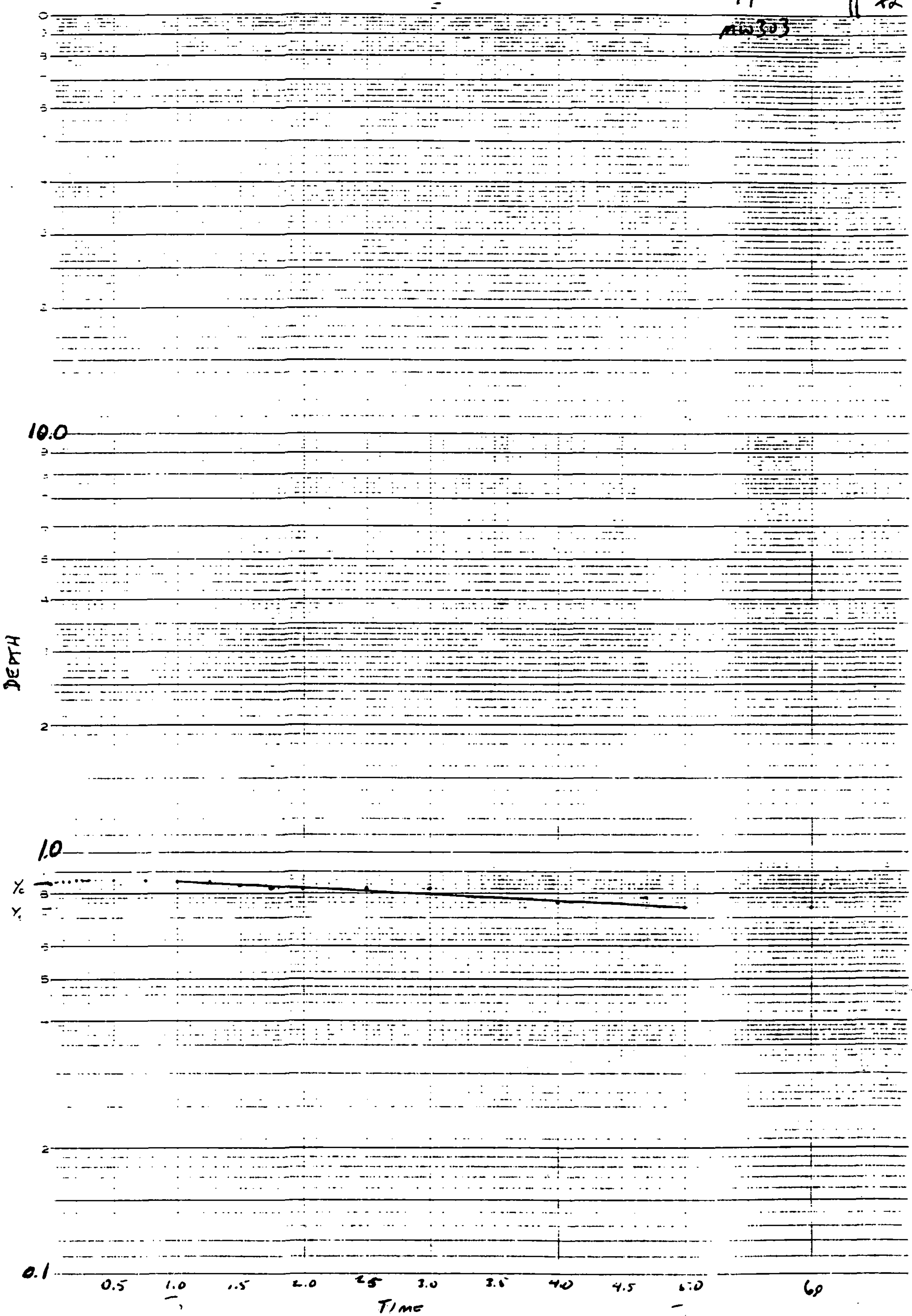
CALCULATION

K in ft/sec = 2.09E-06

K in cm/sec = 6.36E-05

7$63 P. 7 of 11

MW303



P. 8 of RTT

BORING NO. MW 303

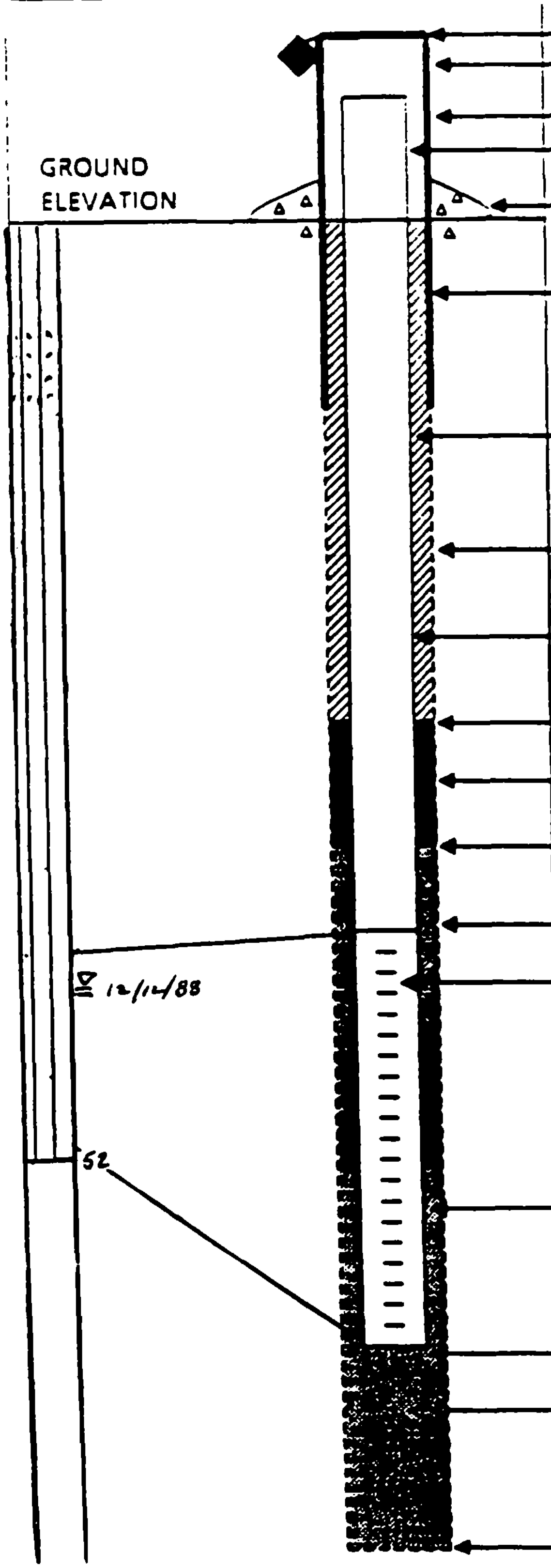
NUS CORPORATION
A Halliburton Company

MONITORING WELL SHEET

PROJECT SHEPPARD AFB
PROJECT NO. 7863
ELEVATION
FIELD GEOLOGIST J. WEDEKIND

LOCATION WICHITA FALLS TX
BORING MW 303
DATE 12/14/88

DRILLER G. POOL
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD AIR LIFT



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 2.60
STICK - UP RISER PIPE: 2.43
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 37.0
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 40.0
ELEVATION / DEPTH TOP OF SCREEN: 42.0
TYPE OF SCREEN: PVC SCHEDULE 40
SLOT SIZE x LENGTH: 0.010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 silica
ELEVATION / DEPTH BOTTOM OF SCREEN: 52.0
ELEVATION / DEPTH BOTTOM OF SAND PACK: 52.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: NONE
ELEVATION / DEPTH OF HOLE: 52.0

Display 3

NUS CORPORATION

WELL No.: MW/303 ELEVATION: ______ DATE: 1/15/89

STATIC WATER LEVEL 45.83 + CORRECTION 0.1 = 45.93 TIME: 1148

ELEVATION WATER ______ REFERENCE INPUT 45.93 XD: 8.69

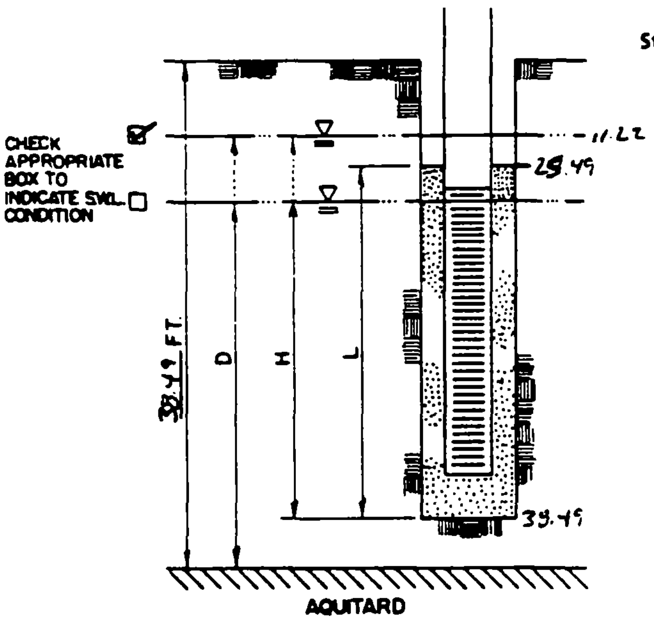
	Sample Number	Time (min)	SLUG IN/OUT		SLUG IN/OUT
			~~46.77~~	~~32~~	
✓	000	0.0000	46.77	32.49	
	001	0.0033	46.78	32.51	
	002	0.0067		32.51	
	003	0.0100		32.51	
	004	0.0133		32.51	
	005	0.0167		32.51	
	006	0.0200		32.51	
	007	0.0233		32.51	
	008	0.0267		32.51	
✓	009	0.0300		32.51	
	010	0.0333		32.51	
✓	011	0.0500		32.51	
	012	0.0667		32.51	
	013	0.0833		32.51	
✓	014	0.1000		32.51	
	015	0.1167	46.79	32.52	
	016	0.1333		32.52	
✓	017	0.1500	46.78	32.51	
	018	0.1667	46.79	32.52	
	019	0.1833		32.52	
✓	020	0.2000		32.52	
	021	0.2167		32.52	
	022	0.2333		32.52	
✓	023	0.2500		32.52	
	024	0.2667		32.52	
	025	0.2833		32.52	
✓	026	0.3000		32.52	
	027	0.3167		32.52	
	028	0.3333		32.52	
✓	029	0.4167		32.52	
✓	030	0.5000		32.52	
	031	0.5833		32.52	
	032	0.6667		32.52	
✓	033	0.7500		32.52	
	034	0.8333	46.78	32.51	
	035	0.9167		32.51	
✓	036	1.0000		32.51	
	037	1.0833		32.51	
	038	1.1667	46.77	[illegible]	
✓	039	1.2500	46.78	32.51	
	040	1.3333	46.77	32.49	
	041	1.4167		32.49	
✓	042	1.5000		32.49	
	043	1.5833	46.75	32.47	
	044	1.6667		32.47	

Sample Number	Time (min)		
045	1.7500	46.75	32.47
046	1.8333		32.47
047	1.9167		32.47
048	2.0000		32.47
049	2.5	46.72	32.44
050	3.0		32.44
051	3.5	46.71	32.43
052	4.0	46.69	32.41
053	4.5		32.41
054	5.0	46.67	32.39
055	5.5		32.39
056	6.0		32.39
057	6.5	46.66	32.38
058	7.0		32.38
059	7.5		32.38
060	8.0	46.64	32.36
061	8.5		32.36
062	9.0		32.36
063	9.5		32.36
064	10.0		32.36
065	12.0		32.36
066	14.0	46.63	32.35
067	16.0		32.35
068	18.0		32.35
069	20.0		32.35
070	22.0		32.35
071	24.0	46.61	32.33
072	26.0	46.61	32.33
073	28.0		32.33
074	30.0		32.33
075	32.0		32.33
076	34.0		32.33
077	36.0		32.33
078	38.0		32.33
079	40.0		32.33
080	42.0		32.33
081	44.0		32.33
082	46.0		32.33
083	48.0		32.33
084	50.0		32.33
085	52.0		32.33
086	54.0		32.33
087	56.0		32.33
088	58.0		32.33
089	60.0		32.33

Sample Number	Time (min		
090	62.0	46.61	32.33
091	64.0		32.33
092	66.0		32.33
093	68.0		32.33
094	70.0		32.33
095	72.0		32.33
096	74.0		32.33
097	76.0		32.33
098	78.0		32.33
099	80.0		32.33
100	82.0		32.33
101	84.0		32.33
102	86.0		32.33
103	88.0		32.33
104	90.0		32.33
105	92.0		32.33
106	94.0		32.33
107	96.0		32.33
108	98.0	46.61	32.33
109	100.0	46.61	32.33
110	110	46.61	32.33
111	120		
112	130		
113	140		
114	150		
115	160		
116	170		
117	180		
118	190		
119	200		
120	210		
121	220		
122	230		
123	240		
124	250		
125	260		
126	270		
127	280		
128	290		
129	300		
130	310		
131	320		
132	330		
133	340		
134	350		

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	TEST BY/DATE:	P. Payne 1/17/89
JOB NUMBER:	7863	CALCULATED BY/DATE:	J. Wedekind 2/3/89
WELL NUMBER:	~~[illegible]~~ MW402	CHECKED BY/DATE:	J. Cook 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 11.22 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 28.49 ft. B.T.O.C.

Bott. Filter Pack = 38.49 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.49 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 10.0 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 27.27 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = ~~300~~ 27.27 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = NA (full), if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 4.04 \times 10^{-5}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 52).

A = ~~3.2~~ NA B = ~~1.95~~ NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 52).

C = ~~NA~~ 2.9 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 05 , T_t = 30 , Y_o = 1.44 , Y_t = .35

$$T = T_t - T_o = 150 \text{ (sec)}$$

Complete Page 5 in its entirety.

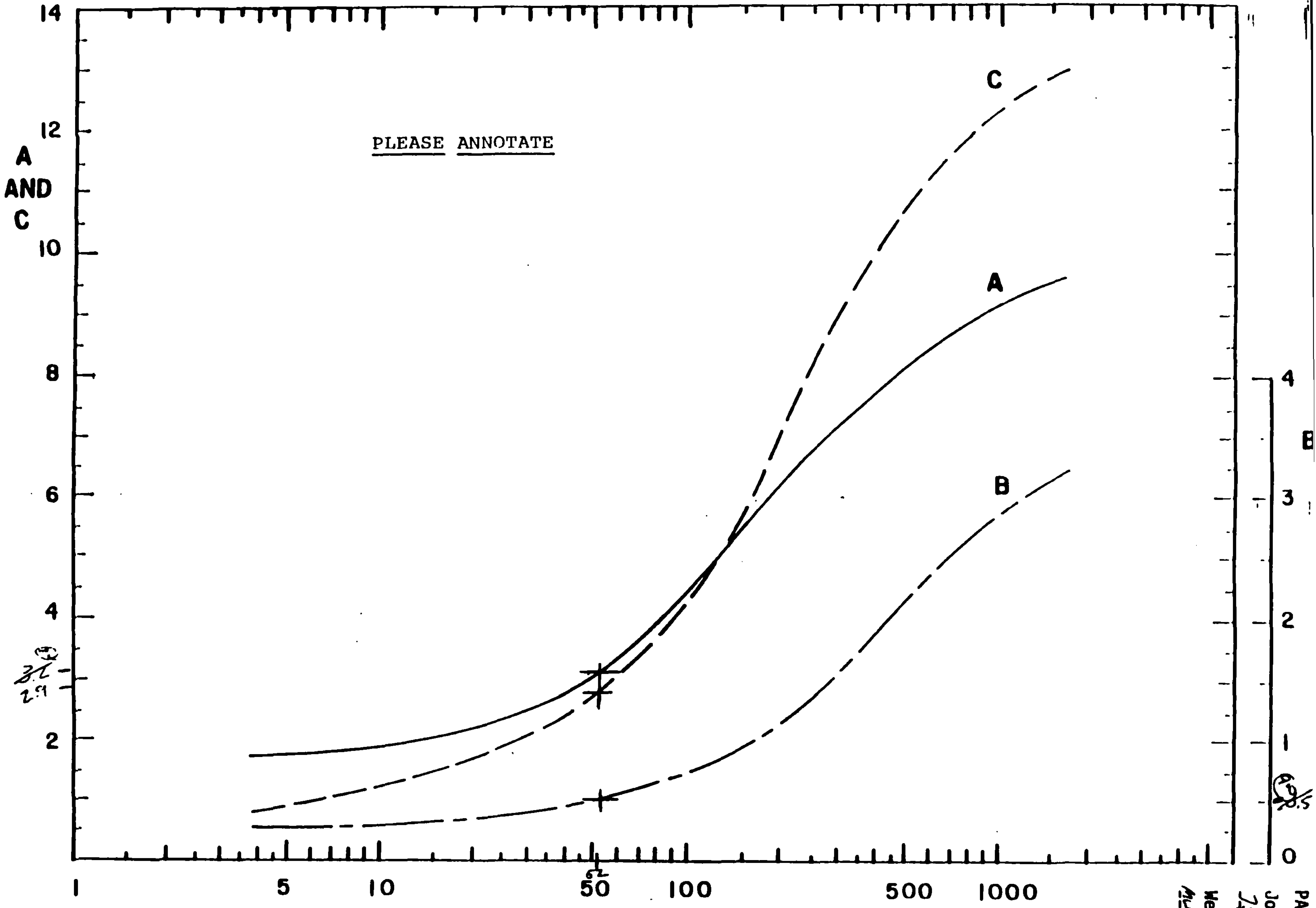


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

Well No
Job No.
PAGE 3

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 11.22 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	1.52				
	0.03	1.52				
	0.05	1.52				
	0.10	1.51				
	0.15	1.50				
	0.20	1.49				
	0.25	1.46				
X_o –	0.50	1.44				
	0.75	1.43				
	1.00	1.41				
	1.50	1.40				
	2.0	1.38				
	2.5	1.36				
X_t –	3.0	1.35				
	4.0	1.32				
	5.0	1.30				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = ~~3~~ NA (N/A if not applicable)

B (from chart) = ~~0.5~~ NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = ~~NA~~ 2.9 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 27.27

D_d = ln[(D - H)/Rw] = NA (must be ≤6)

H, Height of Well Below Water Table (ft) = 27.27

L, Height Through Which Water Enters Well (ft) = 13.0

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds (T_t - T_o) = 150

Y_o, Starting Y (ft) = 1.44

Y_t, Ending Y (ft) = 1.35

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Made the bottom of the sand pack the base of the aquifer based on the clay-rich pedology.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7S63
WELL NO: MW402
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	2.9
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	27.27
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	27.27
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	13
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	150
Yo. STARTING Y (ft) =	1.44
Yt. ENDING Y (ft) =	1.35

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 4.265528

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.445819

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 4.265528
FULLY PENETRATING. ln(Re/Rw) = 3.445819

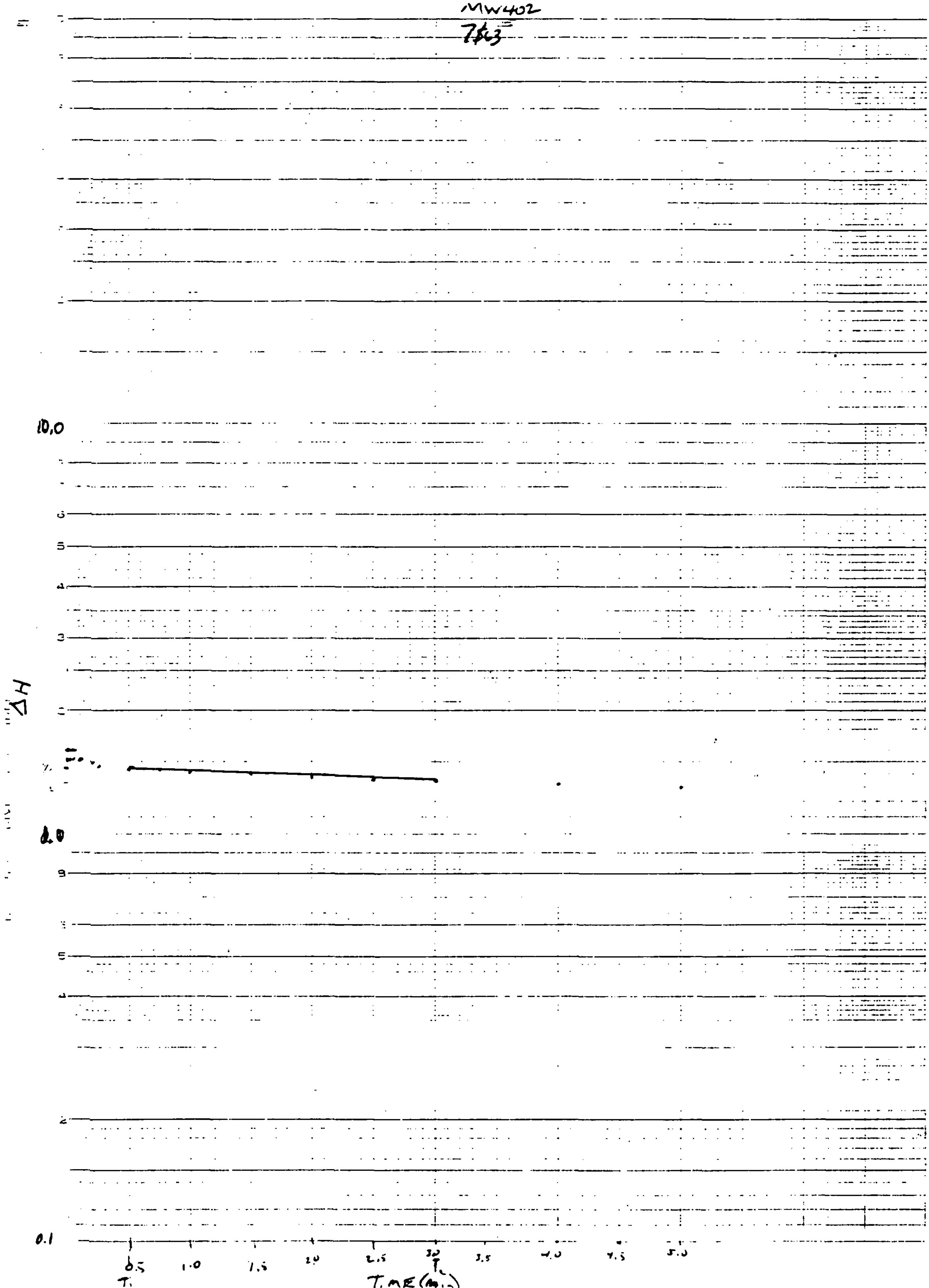
THE CORRECT VALUE OF ln(Re/Rw) IS: 3.445819

CALCULATION

K in ft/sec = 1.32E-06

K in cm/sec = 4.04E-05

MW402
7#63



BORING NO.: MW402

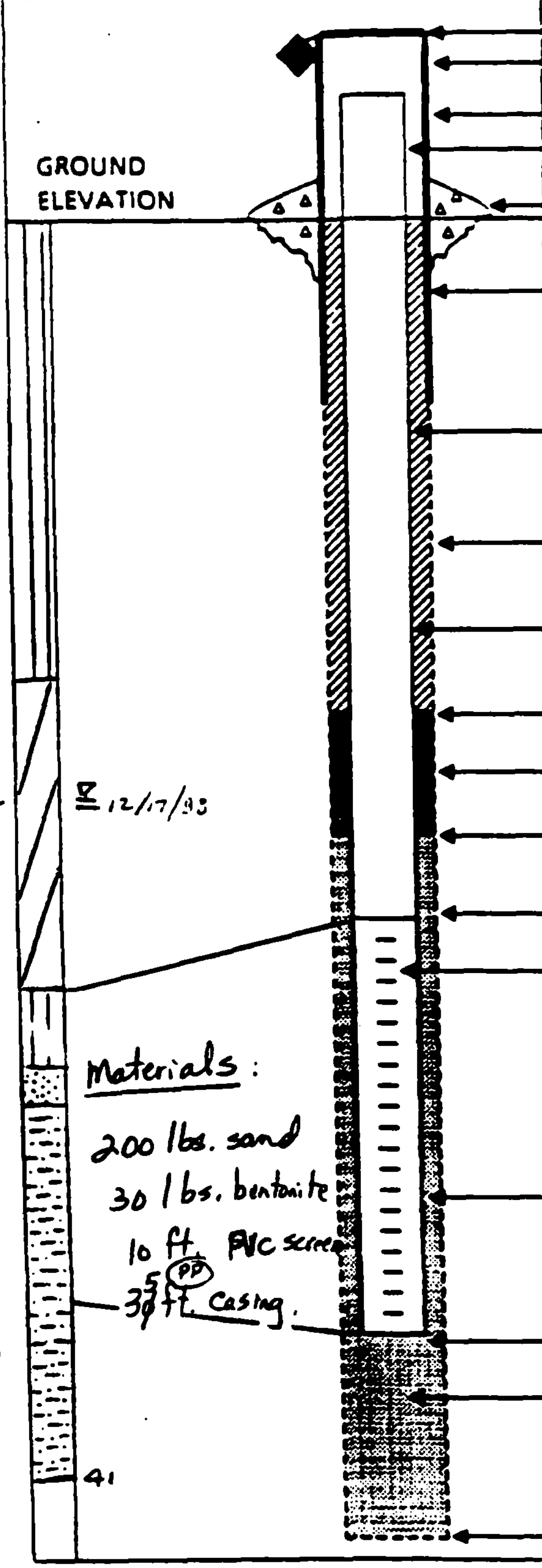
NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT SAFB
PROJECT NO. 7863
ELEVATION ____
FIELD GEOLOGIST J. Wedeking, J. Lewis

LOCATION ____
BORING SB402
DATE ____

DRILLER G. Pool
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift



ELEVATION OF TOP OF SURFACE CASING: ____
ELEVATION OF TOP OF RISER PIPE: ____
STICK - UP TOP OF SURFACE CASING: 2.77
STICK - UP RISER PIPE: 2.49
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: GALVANIZED STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 20
TYPE OF SEAL: BENTONITE PELLETS (1/4")
DEPTH TOP OF SAND PACK: 23
ELEVATION / DEPTH TOP OF SCREEN: 25
TYPE OF SCREEN: ~~Bentonite Pellets~~ PP SCHEDULE 40 PVC ~~.010" x 10'~~ PP
SLOT SIZE x LENGTH: .010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20/40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 35
ELEVATION / DEPTH BOTTOM OF SAND PACK: 36
TYPE OF BACKFILL BELOW OBSERVATION WELL: ~~Hole plug~~ PP Natural material to T.D.
ELEVATION / DEPTH OF HOLE: 41

NUS CORPORATION

WELL NO.: MW402 ELEVATION: ______ DATE: 1/17/89

STATIC WATER LEVEL ____ + CORRECTION ____ = ______ TIME: 17:3

ELEVATION WATER ______ REFERENCE INPUT 11.12 XD: A.11

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	12.74	
	001	0.0033	12.74	
	002	0.0067	12.74	
	003	0.0100	12.74	
	004	0.0133	12.74	
	005	0.0167	12.74	
	006	0.0200	12.74	
	007	0.0233	12.74	
	008	0.0267	12.74	
	009	0.0300	12.74	
✓	010	0.0333	12.74	
✓	011	0.0500	12.74	
	012	0.0667	12.73	
	013	0.0833	12.73	
✓	014	0.1000	12.73	
	015	0.1167	12.72	
	016	0.1333	12.72	
✓	017	0.1500	12.72	
	018	0.1667	12.71	
	019	0.1833	12.71	
✓	020	0.2000	12.71	
	021	0.2167	12.70	
	022	0.2333	12.69	
✓	023	0.2500	12.68	
	024	0.2667	12.68	
	025	0.2833	12.68	
	026	0.3000	12.68	
	027	0.3167	12.67	
	028	0.3333	12.68	
✓	029	0.4167	12.66	
✓	030	0.5000	12.66	
	031	0.5833	12.66	
	032	0.6667	12.65	
✓	033	0.7500	12.65	
	034	0.8333	12.64	
	035	0.9167	12.64	
✓	036	1.0000	12.63	
	037	1.0833	12.63	
	038	1.1667	12.63	
	039	1.2500	12.62	
	040	1.3333	12.62	
	041	1.4167	12.62	
✓	042	1.5000	12.61	
	043	1.5833	12.61	
	044	1.6667	12.61	

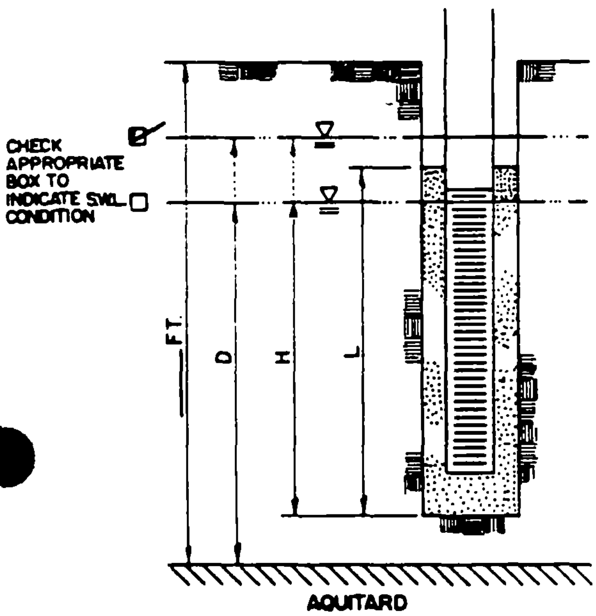
Sample Number	Time (min)	
045	1.7500	12.61
046	1.8333	12.60
047	1.9167	12.60
048	2.0000	12.60
049	2.5	12.58
050	3.0	12.57
051	3.5	12.56
052	4.0	12.54
053	4.5	12.53
054	5.0	12.52
055	5.5	12.51
056	6.0	12.49
057	6.5	12.48
058	7.0	12.47
059	7.5	12.46
060	8.0	12.46
061	8.5	12.45
062	9.0	12.44
063	9.5	12.44
064	10.0	12.43
065	12.0	12.41
066	14.0	12.39
067	16.0	12.37
068	18.0	12.37
069	20.0	12.36
070	22.0	12.34
071	24.0	12.33
072	26.0	12.31
073	28.0	12.31
074	30.0	12.30
075	32.0	12.29
076	34.0	12.28
077	36.0	12.28
078	38.0	12.27
079	40.0	12.26
080	42.0	12.26
081	44.0	12.25
082	46.0	12.25
083	48.0	12.24
084	50.0	12.23
085	52.0	12.23
086	54.0	12.23
087	56.0	12.22
088	58.0	12.22
089	60.0	12.22

Sample Number	Time (min	
090	62.0	12.21
091	64.0	12.20
092	66.0	12.20
093	68.0	12.20
094	70.0	12.20
095	72.0	12.19
096	74.0	12.19
097	76.0	12.18
098	78.0	12.18
099	80.0	12.17
100	82.0	12.17
101	84.0	12.17
102	86.0	12.17
103	88.0	12.17
104	90.0	12.16
105	92.0	END TEST @ 1547
106	94.0	
107	96.0	
108	98.0	
109	100.0	
110	110	
111	120	
112	130	
113	140	
114	150	
115	160	
116	170	
117	180	
118	190	
119	200	
120	210	
121	220	
122	230	
123	240	
124	250	
125	260	
126	270	
127	280	
128	290	
129	300	
130	310	
131	320	
132	330	
133	340	
134	350	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
JOB NUMBER: 7863
WELL NUMBER: MW402

TEST BY/DATE: P. Bosue 1/14/89
CALCULATED BY/DATE: J. Wedekind 2/3/89
CHECKED BY/DATE: J. Mattick 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 11.01 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 28.49 ft. B.T.O.C.

Bott. Filter Pack = 38.49 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.49 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 13.0 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 27.48 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 27.48 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = D=H ∴ NA, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

7.83×10^{-5}

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = ____).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 52).

C = 2.9 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.5, T_t = 1.5, Y_o = 1.64, Y_t = 1.56

$$T = T_t - T_o = 60 \text{ (sec)}$$

Complete Page 5 in its entirety.

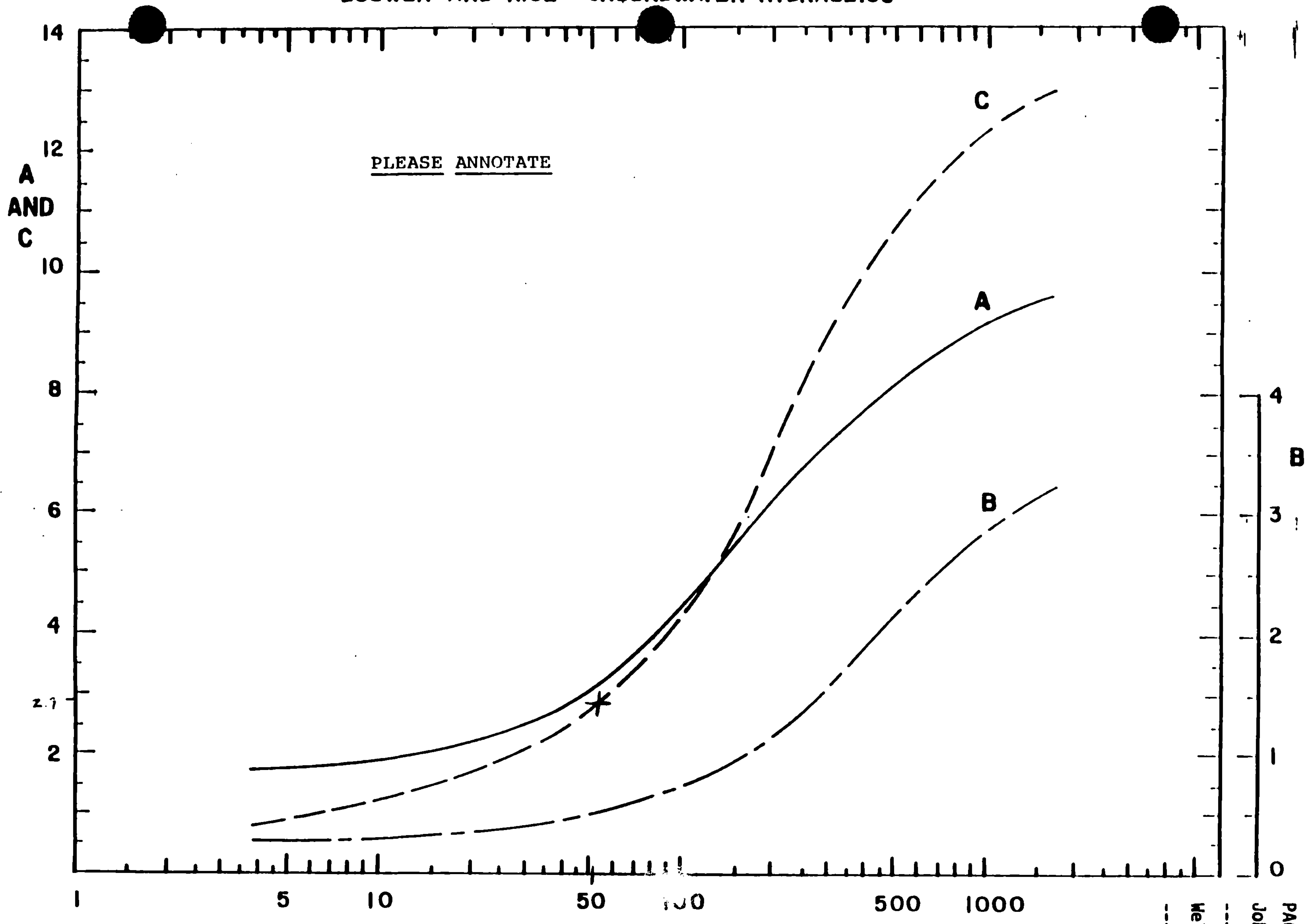


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

Well No

Job No.

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

t = 0 t (min.)	S.W.L. = 11.01 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
0.00	4.45	5.0	1.44		
0.03	5.51	6.0	1.42		
0.05	5.82				
0.10	5.39				
0.15	5.32				
0.20	5.13				
0.25	5.08				
0.30	1.54				
0.42	1.65				
0.50	1.64				
0.58	1.62				
0.75	1.60				
1.00	1.59				
1.08	1.58				
1.25	1.57				
1.50	1.56				
1.75	1.54				
2.00	1.53				
2.50	1.51				
3.00	1.49				
3.50	1.48				
4.0	1.46				
4.5	1.45				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)

B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 2.9 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 27.48

D_d = ln[(D - H)/Rw] = D=H ∴ NA (must be ≤6)

H, Height of Well Below Water Table (ft) = 27.48

L, Height Through Which Water Enters Well (ft) = 13.0

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds (T_t - T_o) = 60

Y_o, Starting Y (ft) = 1.64

Y_t, Ending Y (ft) = 1.56

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Used bottom of sand pack as base of aquifer based on relative impermeability of soil.
Transducer disturbed - see graph.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW402
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	2.9
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	27.48
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	27.48
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	13
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	60
Yo. STARTING Y (ft) =	1.64
Yt. ENDING Y (ft) =	1.56

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 4.272502

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.450368

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 4.272502
FULLY PENETRATING. ln(Re/Rw) = 3.450368

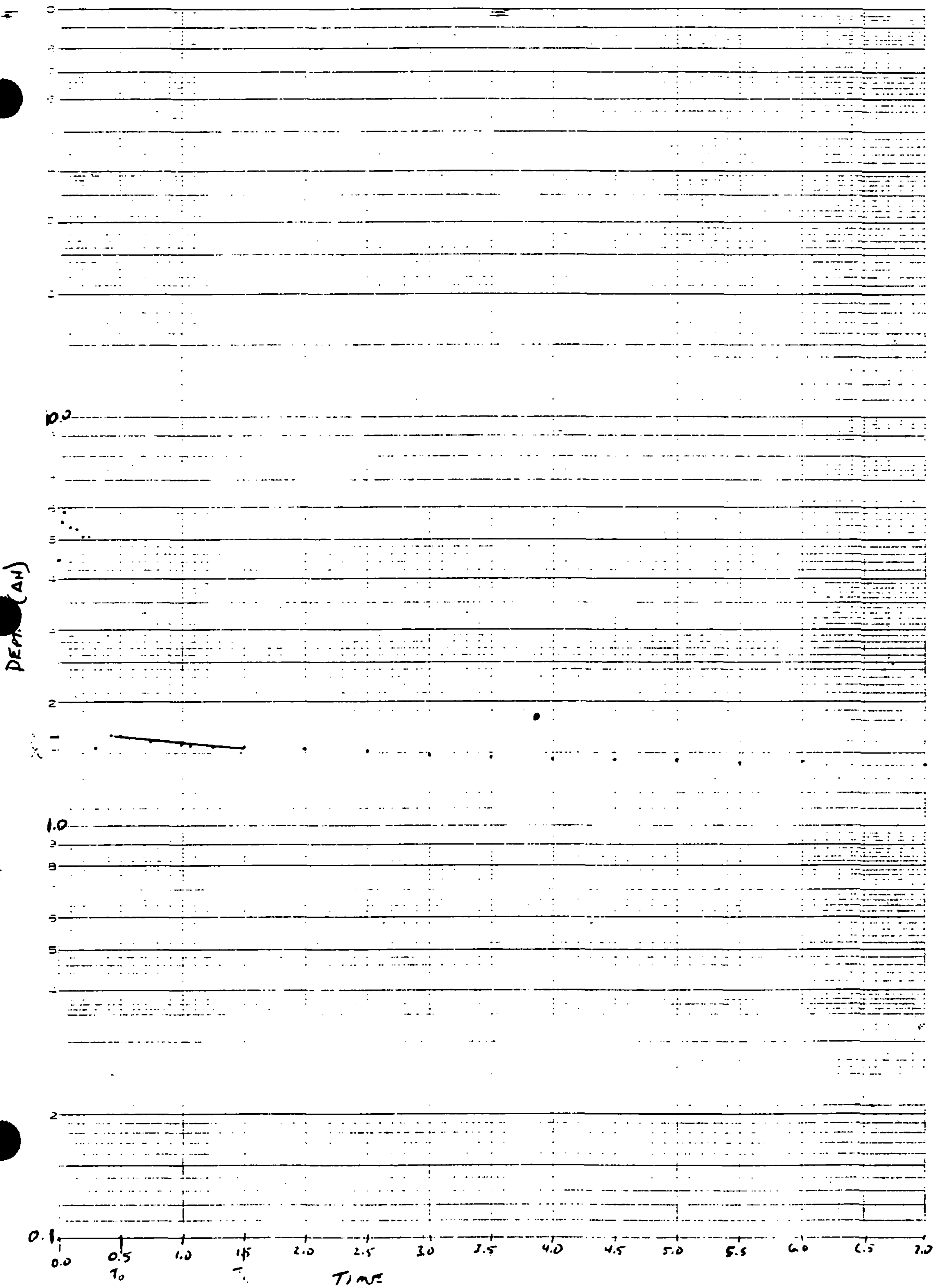
THE CORRECT VALUE OF ln(Re/Rw) IS: 3.450368

CALCULATION

K in ft/sec = 2.57E-06

K in cm/sec = 7.83E-05

MW202



BORING NO.: MW402

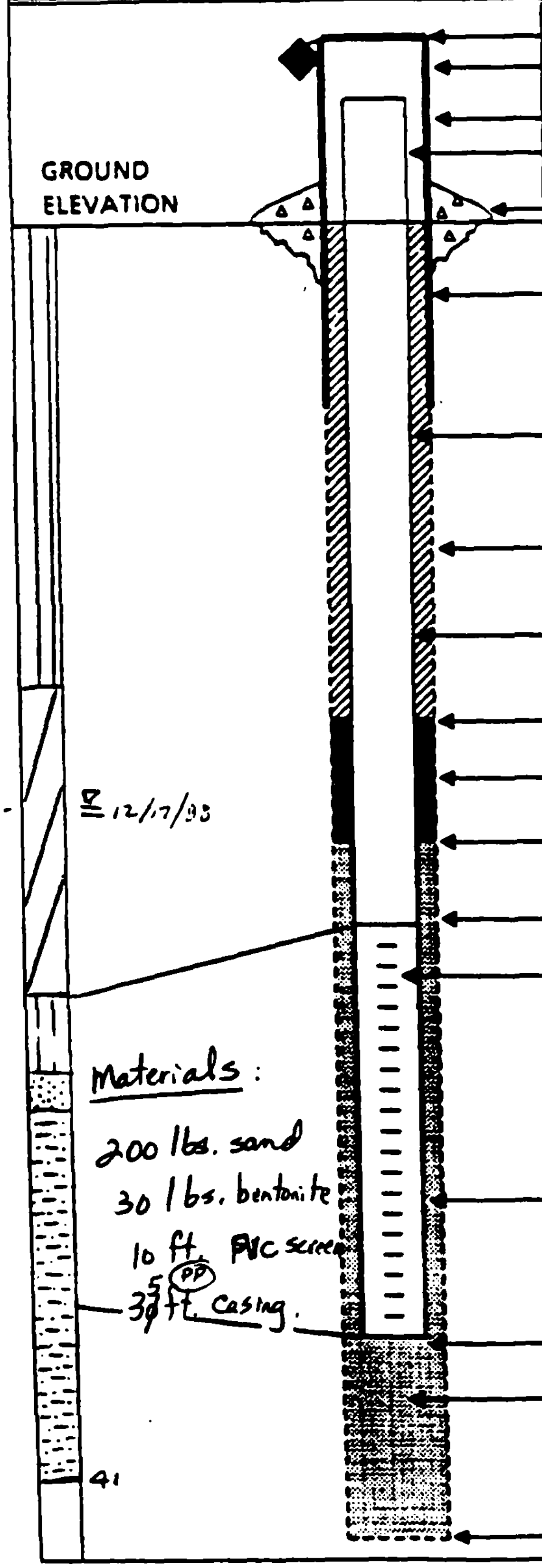
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: $AFB
PROJECT NO.: 7863
ELEVATION:
FIELD GEOLOGIST: J. Wedekind, J. Lewis

LOCATION:
BORING: ~~BB402~~
DATE:

DRILLER: G. Pool
DRILLING METHOD: Air Rotary
DEVELOPMENT METHOD: Air Lift



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: 2.77

STICK - UP RISER PIPE: 2.49

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: GALVANIZED STEEL

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 20

TYPE OF SEAL: BENTONITE PELLETS (1/4")

DEPTH TOP OF SAND PACK: 23

ELEVATION / DEPTH TOP OF SCREEN: 25

TYPE OF SCREEN: ~~Bentonite Pellets~~ (PP) SCHEDULE 40 PVC ~~.010" x 10'~~ (PP)

SLOT SIZE x LENGTH: .010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20/40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 35

ELEVATION / DEPTH BOTTOM OF SAND PACK: 36

TYPE OF BACKFILL BELOW OBSERVATION WELL: ~~Hole plug~~ (PP) Natural material to T.D.

ELEVATION / DEPTH OF HOLE: 41

Displayo

NUS CORPORATION

WELL No.: MW 402 ELEVATION: ______ DATE: 1/14/89
STATIC WATER LEVEL 10.91 + CORRECTION 0.1 = 11.01 TIME: 1016
ELEVATION WATER ______ REFERENCE INPUT 11.01 XD: ______

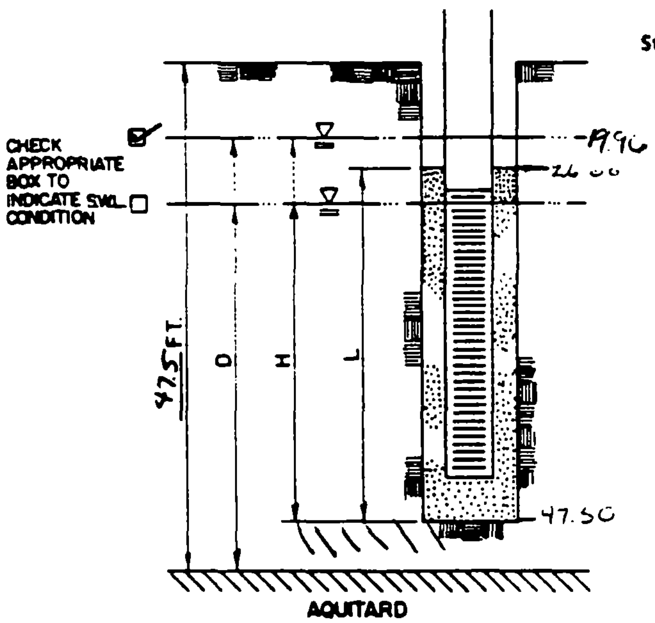
	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	15.46	
	001	0.0033	15.69	
	002	0.0067	15.77	
	003	0.0100	15.80	
	004	0.0133	15.84	
	005	0.0167	15.91	
	006	0.0200	15.98	
	007	0.0233	16.11	
	008	0.0267	16.43	
✓	009	0.0300	16.52	TRANSDUCER DISTURBED
	010	0.0333	16.57	
✓	011	0.0500	16.83	
	012	0.0667	16.80	
	013	0.0833	16.42	
✓	014	0.1000	16.40	
	015	0.1167	16.37	
	016	0.1333	16.40	
✓	017	0.1500	16.33	
	018	0.1667	16.23	
	019	0.1833	16.18	
✓	020	0.2000	16.14	
	021	0.2167	16.12	
	022	0.2333	16.10	
✓	023	0.2500	16.09	
	024	0.2667	16.02	
	025	0.2833	13.69	
✓	026	0.3000	12.55	
	027	0.3167	12.61	
	028	0.3333	12.64	
✓	029	0.4167	12.66	
✓	030	0.5000	12.65	
✓	031	0.5833	12.63	
	032	0.6667	12.62	
✓	033	0.7500	12.61	
	034	0.8333	12.61	
	035	0.9167	12.60	
✓	036	1.0000	12.60	
✓	037	1.0833	12.59	
	038	1.1667	12.59	
✓	039	1.2500	12.58	
	040	1.3333	12.57	
	041	1.4167	12.57	
✓	042	1.5000	12.57	
	043	1.5833	12.57	
	044	1.6667	12.56	

	Sample Number	Time (min)	
	045	1.7500	12.55
	046	1.8333	12.55
	047	1.9167	12.55
	048	2.0000	12.54
	049	2.5	12.52
	050	3.0	12.50
	051	3.5	12.49
	052	4.0	12.47
	053	4.5	12.46
	054	5.0	12.45
	055	5.5	12.44
	056	6.0	12.43
	057	6.5	12.42
	058	7.0	12.41
	059	7.5	12.40
	060	8.0	12.40
	061	8.5	12.39
	062	9.0	12.38
	063	9.5	12.38
	064	10.0	12.37
	065	12.0	12.34
	066	14.0	12.32
	067	16.0	12.30
	068	18.0	12.28
	069	20.0	12.27
	070	22.0	12.25
	071	24.0	12.24
	072	26.0	12.23
	073	28.0	12.22
	074	30.0	12.21
	075	32.0	12.20
	076	34.0	12.19
	077	36.0	12.18
	078	38.0	12.17
	079	40.0	12.16
	080	42.0	12.16
	081	44.0	12.15
	082	46.0	12.15
	083	48.0	12.14
	084	50.0	12.13
	085	52.0	12.13
	086	54.0	12.12
	087	56.0	12.12
	088	58.0	12.11
	089	60.0	12.11

Sample Number	Time (min	
090	62.0	12.10
091	64.0	12.09
092	66.0	12.09
093	68.0	12.09
094	70.0	12.09
095	72.0	12.08
096	74.0	12.08
097	76.0	12.07
098	78.0	12.07
099	80.0	12.07
100	82.0	12.06
101	84.0	12.06
102	86.0	12.05
103	88.0	12.05
104	90.0	12.05
105	92.0	12.04
106	94.0	12.04
107	96.0	12.04
108	98.0	12.03
109	100.0	12.03
110	110	12.01
111	120	12.00
112	130	11.99
113	140	11.98
114	150	11.97
115	160	
116	170	
117	180	
118	190	
119	200	
120	210	
121	220	
122	230	
123	240	
124	250	
125	260	
126	270	
127	280	
128	290	
129	300	
130	310	
131	320	
132	330	
133	340	
134	350	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	TEST BY/DATE:	P. Pogue 1/14/89
JOB NUMBER:	7$63	CALCULATED BY/DATE:	J. Weddeken 2/13/89
WELL NUMBER:	MW403	CHECKED BY/DATE:	J. Conti 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 19.96 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 26.00 ft. B.T.O.C.

Bott. Filter Pack = 47.50 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = ~2.5 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 21.50 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 27.54 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 27.54 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = D.N, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 1.12 \times 10^{-5}}$

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using
L/R_w = ____).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using
L/R_w = 86).

C = 3.9 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.10 , T_t = 1.5 , Y_o = 1.90 , Y_t = 1.87

$$T = T_t - T_o = 84 \text{ (sec)}$$

Complete Page 5 in its entirety.

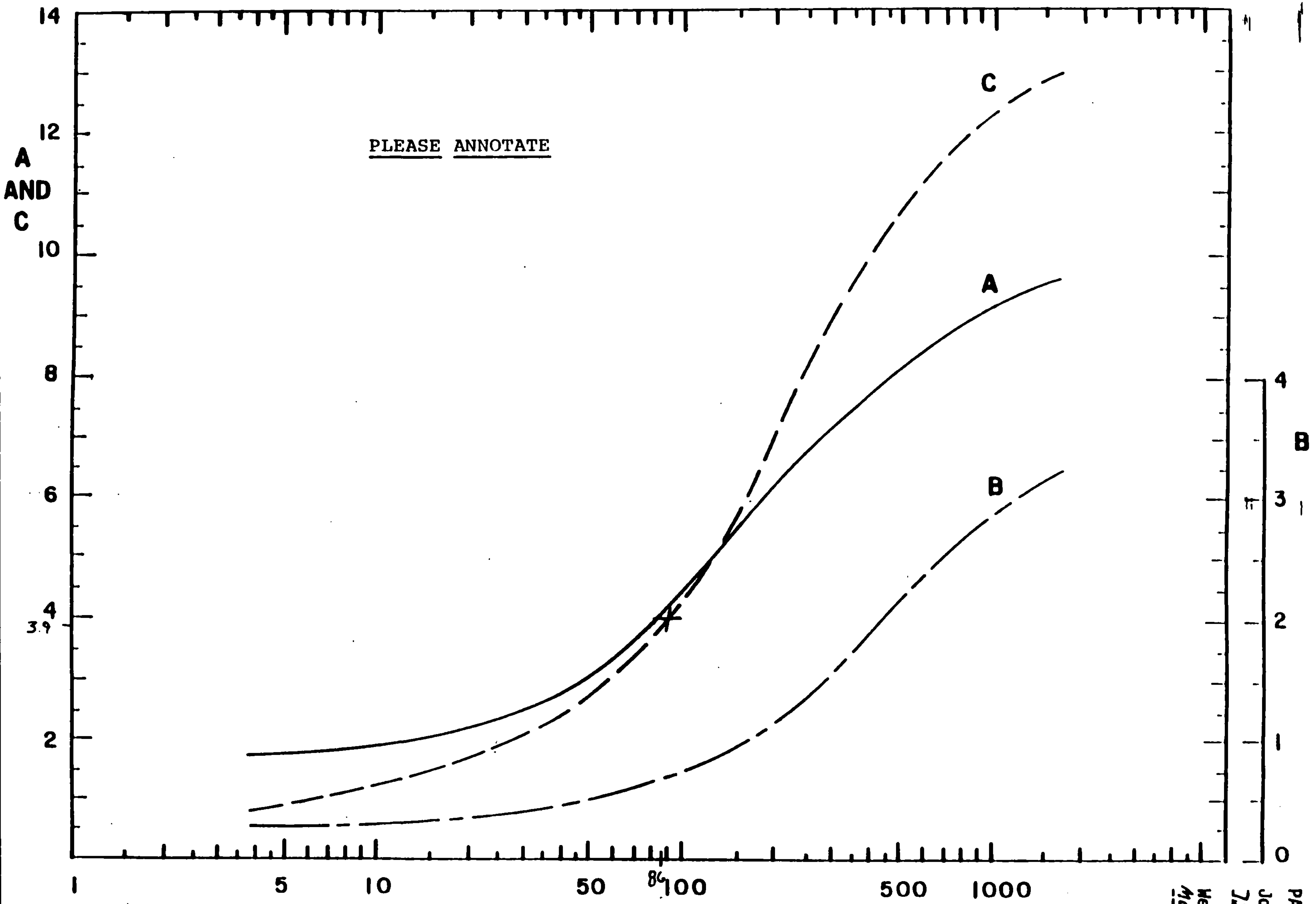


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

Job No. 783
Well No. MW403

PLOT y versus t (from field data, attached at back):

where:

- t = time measured in field during slug test
- y = depth to static water table minus depth to falling water level (for slug injection)

or

- y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 19.96 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	2.17				
	0.05	1.87				
X_o	0.10	1.90				
	0.15	1.89				
	0.20	1.89				
	0.3	1.89				
	0.5	1.87				
	1.0	1.87				
X_t	1.5	1.87				
	2.0	1.87				
	3.0	1.85				
	4.0	1.85				
	5.0	1.85				
	6.0	1.85				
	7.0	1.85				

Job No. 7863
Well No. MW403

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)
B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 3.9 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 27.54
D_d = ln[(D - H)/Rw] = D=H (must be ≤6)
H, Height of Well Below Water Table (ft) = 27.54
L, Height Through Which Water Enters Well (ft) = 21.50
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 84
Y_o, Starting Y (ft) = 1.90
Y_t, Ending Y (ft) = 1.87

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Used bottom of filter pack as impermeable boundary due to marked difference in apparent porosity.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7S63
WELL NO: MW403
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	3.9
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	27.54
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	27.54
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	21.5
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	84
Yo. STARTING Y (ft) =	1.9
Yt. ENDING Y (ft) =	1.87

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 4.274485

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.580441

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

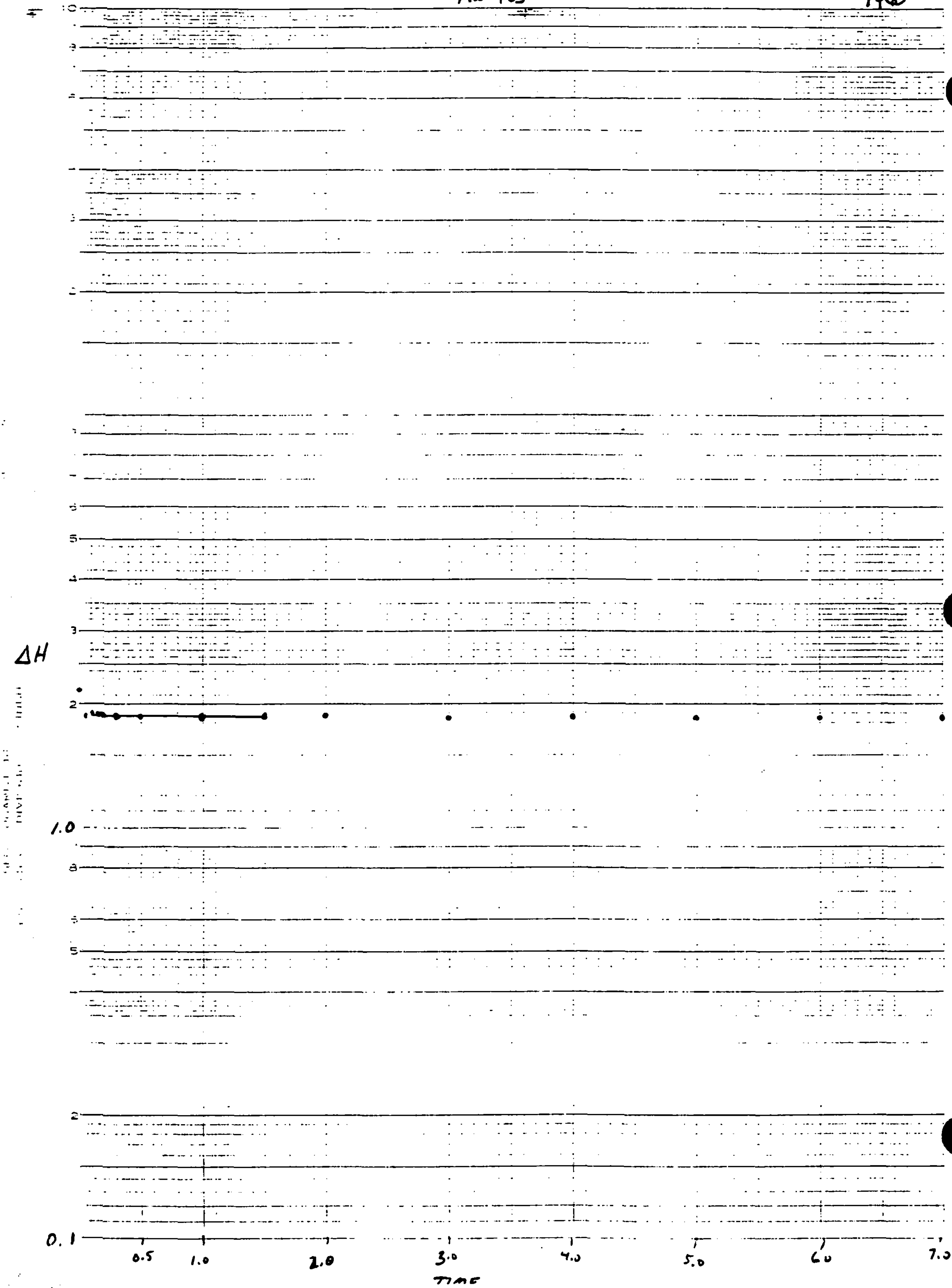
PARTIALLY PENETRATING. ln(Re/Rw) = 4.274485
FULLY PENETRATING. ln(Re/Rw) = 3.580441

THE CORRECT VALUE OF ln(Re/Rw) IS: 3.580441

CALCULATION

K in ft/sec = 3.66E-07

K in cm/sec = 1.12E-05


ΔH
1.0
0.1
0.5
1.0
2.0
3.0
4.0
5.0
6.0
7.0
TIME

BORING NO.: MW 403

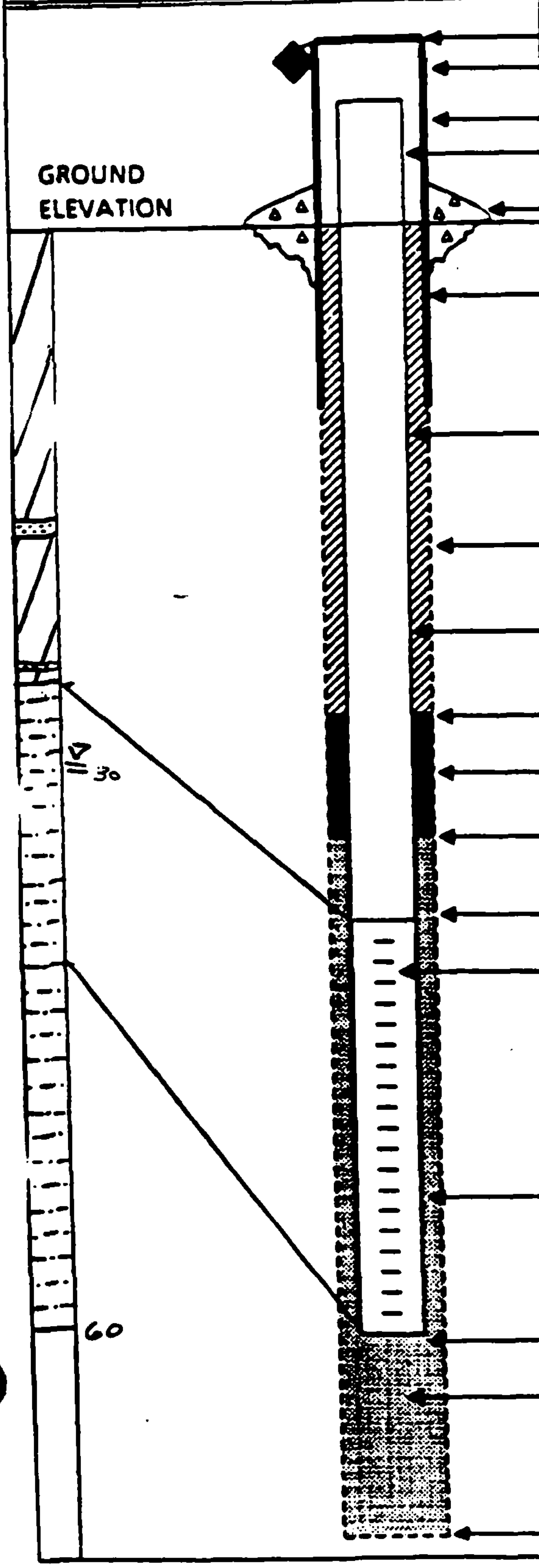
NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
PROJECT NO.: 7863
ELEVATION:
FIELD GEOLOGIST: J. WEDEKIND

LOCATION: WICHITA FALLS, TX
BORING: MW 403
DATE: 12/14/88

DRILLER: W. CALDWELL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT/Bailing



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: CONCRETE PAD 4'×4×6"
I.D. OF SURFACE CASING: 6" × 5'
TYPE OF SURFACE CASING: ~~[illegible]~~ STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 20.5
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 23.5
ELEVATION / DEPTH TOP OF SCREEN: 25
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010 × 15'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 40
ELEVATION / DEPTH BOTTOM OF SAND PACK: 45
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG 60-45
— SEDIMENT TRAP 45-40 —
ELEVATION / DEPTH OF HOLE: 60'

Display 1

50 psi
XD

NUS CORPORATION

WELL NO.: MW 403 ELEVATION: ______ DATE: 1/14/89

STATIC WATER LEVEL 19.86 + CORRECTION 0.1 = 19.96 TIME: 161

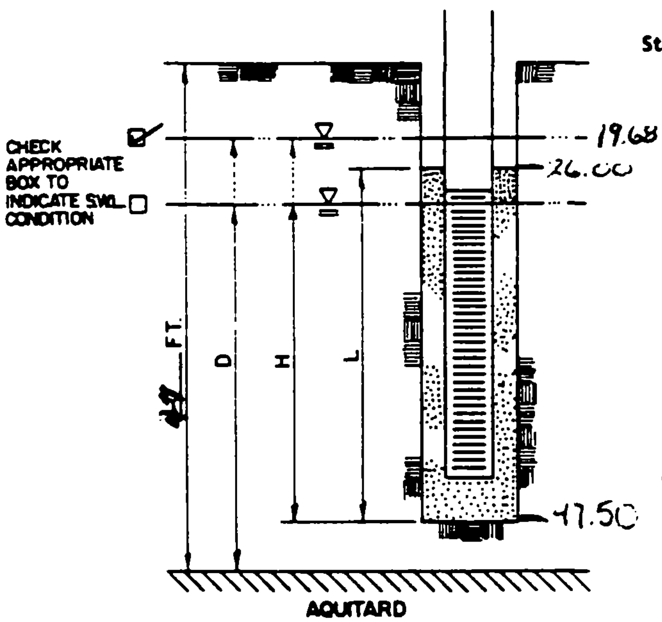
ELEVATION WATER ______ REFERENCE INPUT 19.96 XD: 26.42

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
	000	0.0000	21.80	
✓	001	0.0033	22.13	
	002	0.0067	22.16	
	003	0.0100	21.93	
	004	0.0133	21.67	
	005	0.0167	21.67	
	006	0.0200	21.89	
	007	0.0233	22.07	
	008	0.0267	22.04	
	009	0.0300	21.85	
	010	0.0333	21.72	
✓	011	0.0500	21.83	
	012	0.0667	21.91	
	013	0.0833	21.91	
✓	014	0.1000	21.86	
	015	0.1167	21.83	
	016	0.1333	21.83	
✓	017	0.1500	21.85	
	018	0.1667	21.85	
	019	0.1833	21.85	
✓	020	0.2000	21.85	
	021	0.2167	21.85	
	022	0.2333	21.85	
✓	023	0.2500	21.86	
	024	0.2667	21.85	
	025	0.2833	21.85	
✓	026	0.3000	21.85	
	027	0.3167	21.85	
	028	0.3333	21.85	
	029	0.4167	21.85	
✓	030	0.5000	21.83	
	031	0.5833	21.83	
	032	0.6667	21.83	
	033	0.7500	21.83	
	034	0.8333	21.83	
	035	0.9167	21.83	
✓	036	1.0000	21.83	
	037	1.0833	21.83	
	038	1.1667	21.83	
	039	1.2500	21.83	
	040	1.3333	21.83	
	041	1.4167	21.83	
✓	042	1.5000	21.83	
	043	1.5833	21.83	
	044	1.6667	21.83	

Sample Number	Time (min)	
045	1.7500	21.81 ← no error!
046	1.8333	21.83
047	1.9167	21.83
048	2.0000	21.83
049	2.5	21.81
050	3.0	21.81
051	3.5	21.81
052	4.0	21.81
053	4.5	21.81
054	5.0	21.81
055	5.5	21.81
056	6.0	21.81
057	6.5	21.81
058	7.0	21.81
059	7.5	21.81
060	8.0	21.81
061	8.5	21.80
062	9.0	21.80
063	9.5	21.80
064	10.0	21.80
065	12.0	21.80
066	14.0	21.80
067	16.0	21.80
068	18.0	21.80
069	20.0	21.80
070	22.0	21.78
071	24.0	21.78
072	26.0	21.78
073	28.0	21.78
074	30.0	21.78
075	32.0	21.78
076	34.0	21.78
077	36.0	21.78
078	38.0	21.78
079	40.0	21.78
080	42.0	21.78
081	44.0	21.78
082	46.0	21.78
083	48.0	21.78
084	50.0	21.78
085	52.0	21.77
086	54.0	21.78
087	56.0	21.77
088	58.0	21.78
089	60.0	21.77

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	**TEST BY/DATE:**	J. Wedekind 1/17/89
JOB NUMBER:	7863	**CALCULATED BY/DATE:**	J. Wedekind 2/3/89
WELL NUMBER:	MW403	**CHECKED BY/DATE:**	J. Cost. 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 19.68 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 26.00 ft. B.T.O.C.

Bott. Filter Pack = 47.5 ft. B.T.O.C.

Screen Length = 15' ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.5 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 21.50 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 27.82 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 27.82 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = D=H, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

3.41×10^{-5} cm/sec

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

<u>CONDITION #1</u>, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 86).

A = NA B = NA (N/A if not applicable).

<u>CONDITION #2</u>, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 86).

C = 3.9 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.75 , T_t = 1.5 , Y_o = 1.56 , Y_t = 1.52

$$T = T_t - T_o = \underline{45} \text{ (sec)}$$

Complete Page 5 in its entirety.

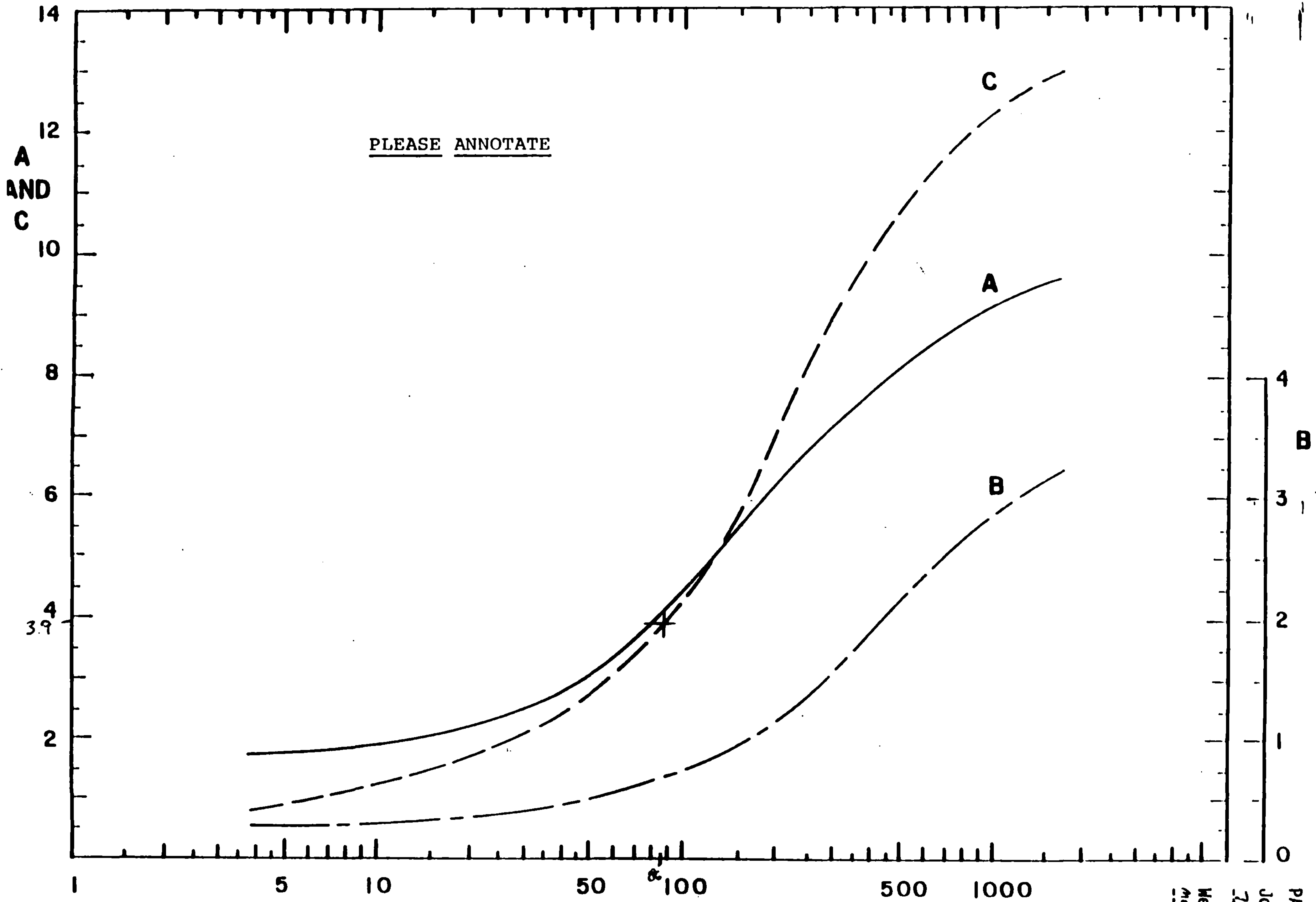


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

PAGE 3
Job No. 7363
Well No. MW4

Job No. 7163
Well No. MW403

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 19.68 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	2.01				
	0.05	1.84				
*	0.58	1.60				
X_0 -	0.75	1.56				
	1.0	1.54				
X_L -	1.5	1.52				
	2.0	1.52				
	2.5	1.51				
	3.0	1.51				
	4.0	1.50				
	5.0	1.50				
	6.0	1.50				
	7.0	1.49				

* Transducer disturbed from 0.05 - 0.5 minutes.

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = N/A (N/A if not applicable)

B (from chart) = N/A (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 3.9 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 27.82

D_d = ln[(D - H)/Rw] = D=H (must be ≤6)

H, Height of Well Below Water Table (ft) = 27.82

L, Height Through Which Water Enters Well (ft) = 21.50

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds (T_t - T_o) = 45

Y_o, Starting Y (ft) = 1.56

Y_t, Ending Y (ft) = 1.52

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Used bottom of sand pack as impermeable boundary due to very low permeability.

Transducer disturbed early in the readings.
May not have run test long enough (1.5 hrs)

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7S63
WELL NO: MW403
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	3.9
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	27.82
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	27.82
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	21.5
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	45
Yo. STARTING Y (ft) =	1.56
Yt. ENDING Y (ft) =	1.52

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 4.283681

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.586891

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 4.283681
FULLY PENETRATING. ln(Re/Rw) = 3.586891

THE CORRECT VALUE OF ln(Re/Rw) IS: 3.586891

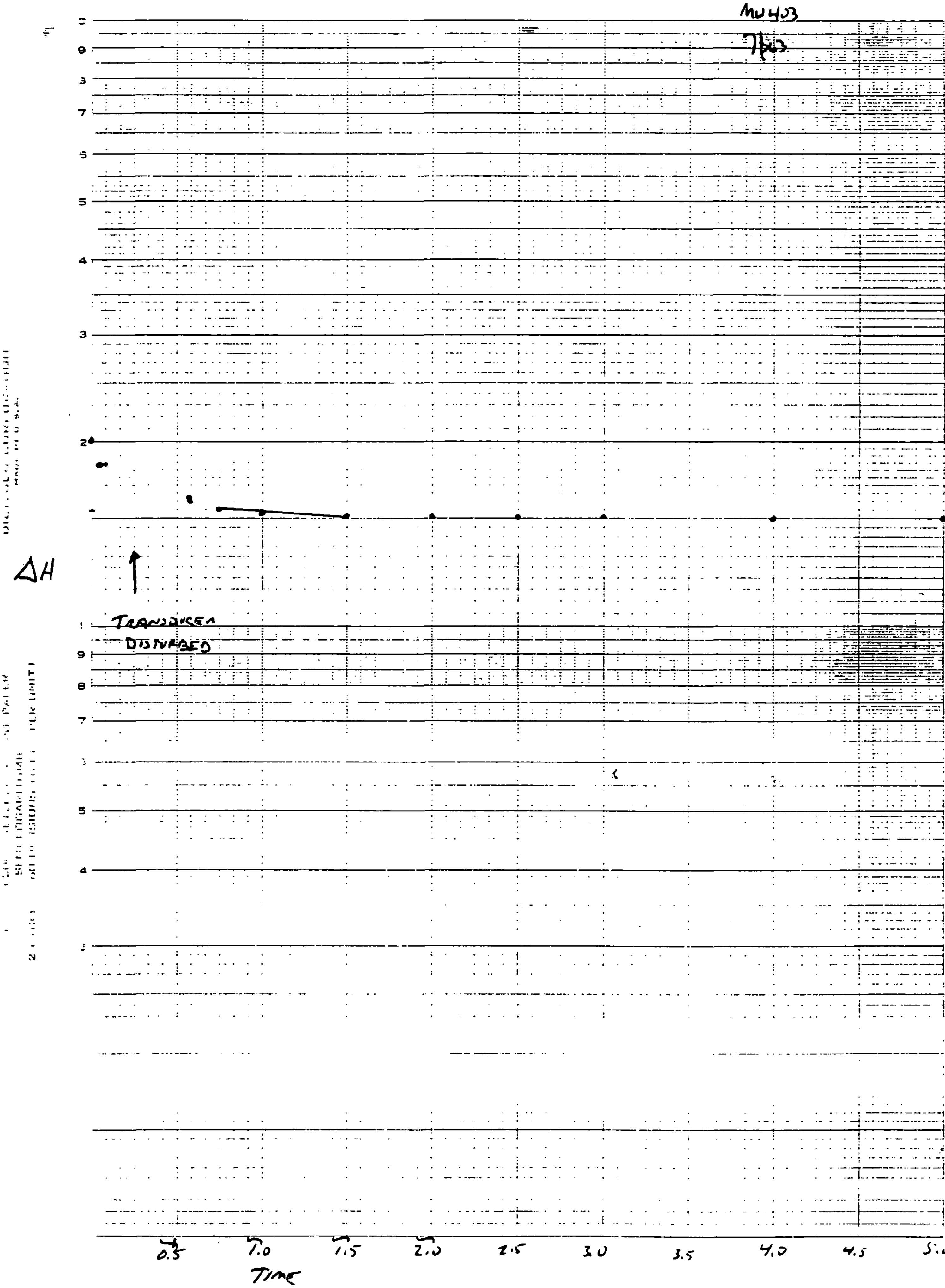
CALCULATION

K in ft/sec = 1.12E-06

K in cm/sec = 3.41E-05

MW 403

7/63



BORING NO.: MW 403

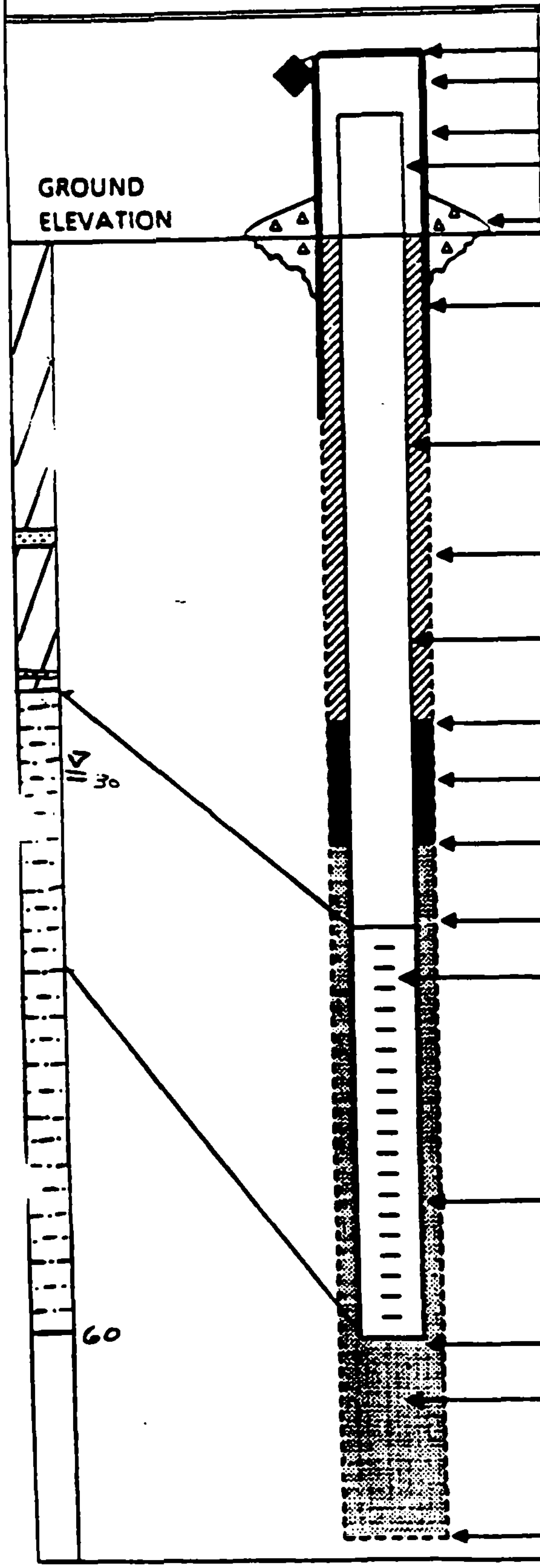
NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
PROJECT NO.: 7863
ELEVATION:
FIELD GEOLOGIST: J. WEDEKIND

LOCATION: WICHITA FALLS, TX
BORING: MW 403
DATE: 12/14/88

DRILLER: W. CALDWELL
DRILLING METHOD: AIR ROTARY
DEVELOPMENT METHOD: AIR LIFT/Bailing



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING: ~2.7
STICK-UP RISER PIPE: ~2.5
TYPE OF SURFACE SEAL: CONCRETE PAD 4×4×6"
I.D. OF SURFACE CASING: 6" × 5'
TYPE OF SURFACE CASING: ~~[illegible]~~ STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 20.5
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 23.5
ELEVATION / DEPTH TOP OF SCREEN: 25
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 0.010 × 15'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 40
ELEVATION / DEPTH BOTTOM OF SAND PACK: 45
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG 60-45
— SEDIMENT TRAP 45-40 —
ELEVATION / DEPTH OF HOLE: 60'

DISPLAY 2

NUS CORPORATION

WELL NO.: MW 403 ELEVATION: ______ DATE: 1/17/39

STATIC WATER LEVEL ____ + CORRECTION ____ = 10.39 19.68 TIME: [illegible]

ELEVATION WATER ______ REFERENCE INPUT 19.68 XD: 10:39

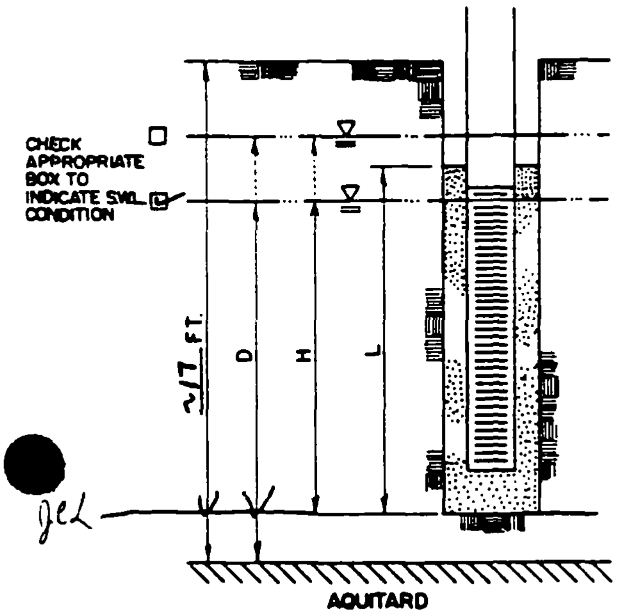
	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	21.69	
	001	0.0033	21.66	
	002	0.0067	21.55	
	003	0.0100	21.48	
	004	0.0133	21.52	
	005	0.0167	21.61	
	006	0.0200	21.65	
	007	0.0233	21.62	
	008	0.0267	21.55	
	009	0.0300	21.52	
	010	0.0333	21.55	
✓	011	0.0500	21.52	
	012	0.0667	21.54 *	
	013	0.0833	21.58	
	014	0.1000	21.64	
	015	0.1167	21.75	
	016	0.1333	21.72	
	017	0.1500	21.93	
	018	0.1667	22.16	
	019	0.1833	22.70	
	020	0.2000	22.96	
	021	0.2167	23.40	
	022	0.2333	23.60	
	023	0.2500	24.54	
	024	0.2667	24.70	
	025	0.2833	24.90	
	026	0.3000	25.07	* TRANSDUCER DISTURBED
	027	0.3167	25.42	
	028	0.3333	25.32	
	029	0.4167	23.46	
			*	
	030	0.5000	21.50	
✓	031	0.5833	21.28	
	032	0.6667	21.26	
✓	033	0.7500	21.24	
	034	0.8333	21.23	
	035	0.9167	21.23	
✓	036	1.0000	21.22	
	037	1.0833	21.21	
	038	1.1667	21.21	
	039	1.2500	21.21	
	040	1.3333	21.20	
	041	1.4167	21.20	
✓	042	1.5000	21.20	
	043	1.5833	21.20	
	044	1.6667	21.20	

	Sample Number	Time (min)	
	045	1.7500	21.20
	046	1.8333	21.20
	047	1.9167	21.20
✓	048	2.0000	21.20
✓	049	2.5	21.19
	050	3.0	21.19
	051	3.5	21.19
✓	052	4.0	21.18
	053	4.5	21.18
	054	5.0	21.18
	055	5.5	21.18
	056	6.0	21.18
	057	6.5	21.18
	058	7.0	21.17
	059	7.5	21.17
	060	8.0	21.17
	061	8.5	21.17
	062	9.0	21.17
	063	9.5	21.16
	064	10.0	21.16
	065	12.0	21.16
	066	14.0	21.15
	067	16.0	21.15
	068	18.0	21.15
	069	20.0	21.14
	070	22.0	21.14
	071	24.0	21.14
	072	26.0	21.14
	073	28.0	21.13
	074	30.0	21.13
	075	32.0	21.13
	076	34.0	21.13
	077	36.0	21.13
	078	38.0	21.12
	079	40.0	21.12
	080	42.0	21.12
	081	44.0	21.12
	082	46.0	21.12
	083	48.0	21.12
	084	50.0	21.12
	085	52.0	21.11
	086	54.0	21.11
	087	56.0	21.11
	088	58.0	21.11
	089	60.0	21.11

Sample Number	Time (min	
090	62.0	21.10
091	64.0	21.10
092	66.0	21.10
093	68.0	21.10
094	70.0	21.10
095	72.0	21.09
096	74.0	21.09
097	76.0	21.09
098	78.0	21.09
099	80.0	21.09
100	82.0	21.09
101	84.0	21.09
102	86.0	21.08
103	88.0	21.08
104	90.0	21.08
105	92.0	
106	94.0	
107	96.0	
108	98.0	
109	100.0	
110	110	
111	120	
112	130	
113	140	
114	150	
115	160	
116	170	
117	180	
118	190	
119	200	
120	210	
121	220	
122	230	
123	240	
124	250	
125	260	
126	270	
127	280	
128	290	
129	300	
130	310	
131	320	
132	330	
133	340	
134	350	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	TEST BY/DATE:	P. Payne : 1/13/89
JOB NUMBER:	7563	CALCULATED BY/DATE:	J. Wedekind 2/6/89
WELL NUMBER:	MW/501	CHECKED BY/DATE:	J. [illegible] 4/[illegible]/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 7.17 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 2.87 ft. B.T.O.C.

Bott. Filter Pack = 21.87 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 0.125 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/~~partially~~ penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 14.70 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 14.70 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 14.70 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = NA, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

7.03×10^{-4}

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w =).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 58.3).

C = 3.0 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.50, T_t = 1.50, Y_o = 1.07, Y_t = 0.61

$$T = T_t - T_o = 60 \text{ (sec)}$$

Complete Page 5 in its entirety.

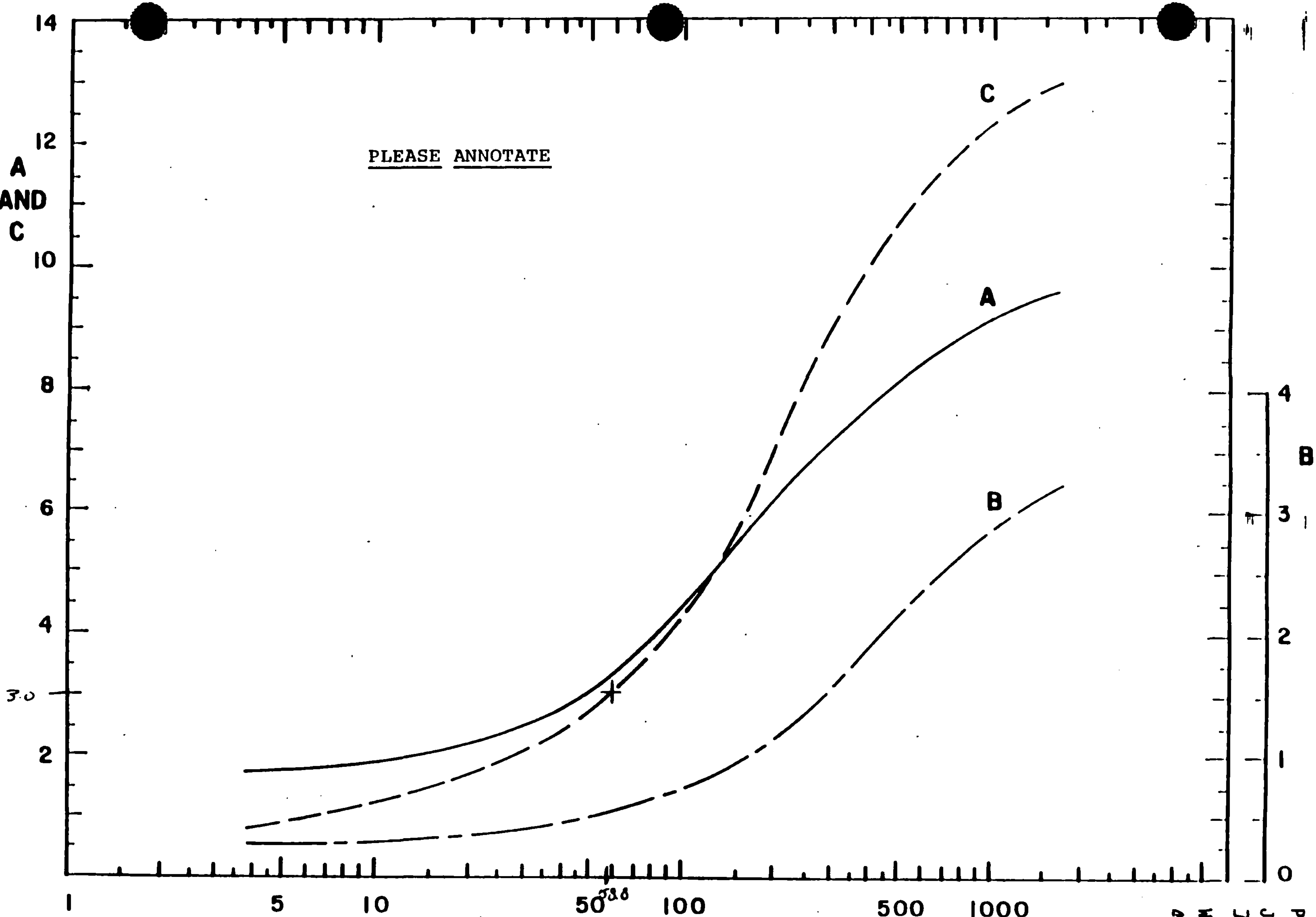


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

Job No. 7363
Well No MW-501

Job No. 7563
Well No. MW501

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 / t (min.)	S.W.L. = 7.17 / y (feet)		t (min.)	y (feet)	t (min.)	y (feet)
	0.00	1.73		6.0	0.30		
	0.03	1.66		7.0	0.27		
	0.05	1.63					
	0.10	1.54					
	0.15	1.47					
	0.20	1.40					
	0.25	1.34					
	0.30	1.28					
	0.33	1.24					
	0.41	1.15					
X_o -	0.50	1.07					
	0.66	0.94					
	0.75	0.89					
	1.00	0.77					
	1.25	0.68					
X_t -	1.50	0.61 (0.63)					
	1.75	0.58					
	2.00	0.55					
	2.50	0.49					
	3.0	0.44					
	3.5	0.41					
	4.0	0.38					
	5.0	0.34					

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)
B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

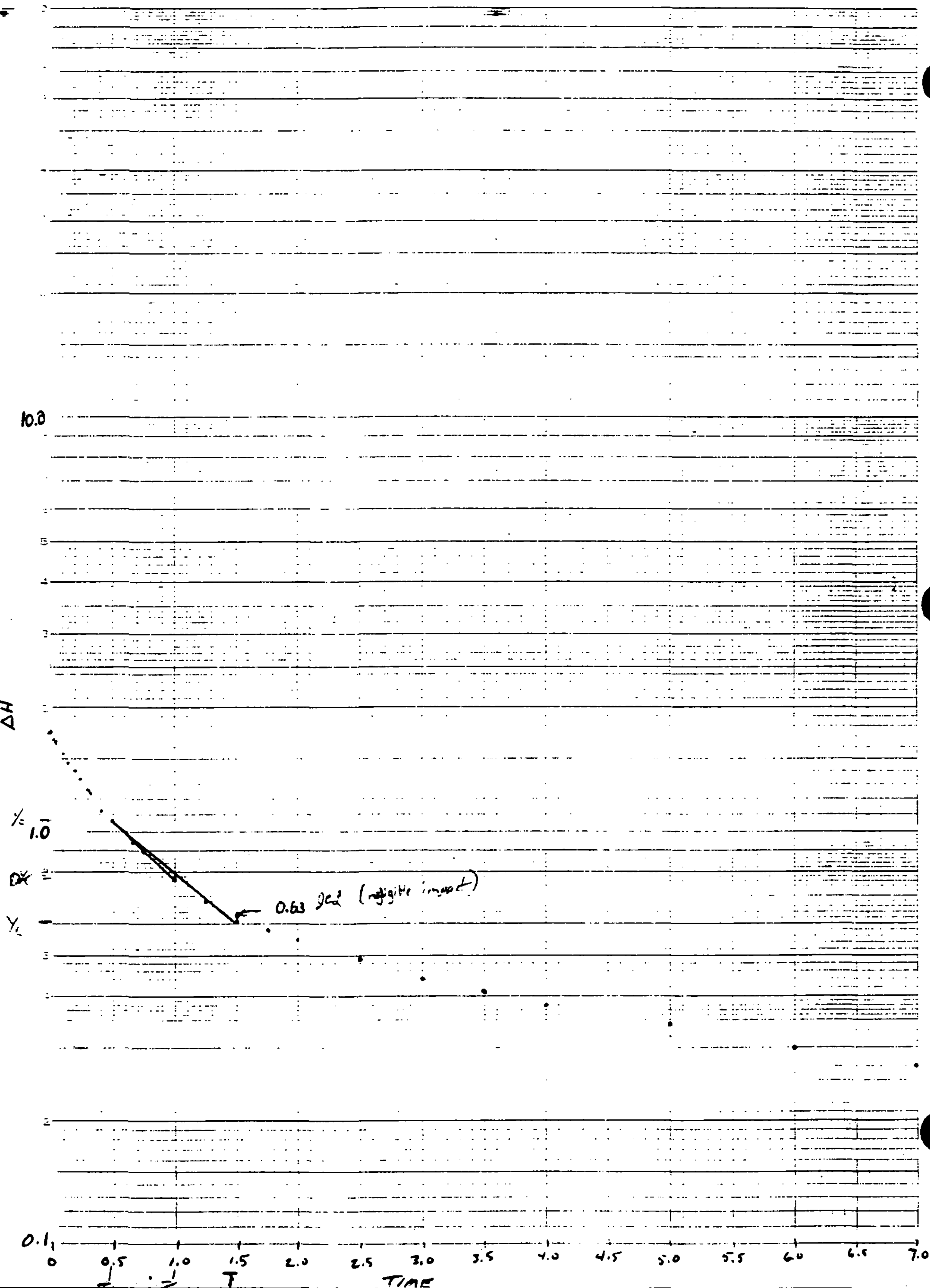
C (from chart) = 3.0 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 14.70
D_d = ln[(D - H)/Rw] = NA (must be ≤6)
H, Height of Well Below Water Table (ft) = 14.70
L, Height Through Which Water Enters Well (ft) = 14.70
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 60
Y_o, Starting Y (ft) = 1.07
Y_t, Ending Y (ft) = 0.61

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Well screened below impermeable boundary. Assumed bottom of filter pack is bottom of aquifer.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.

MWS01

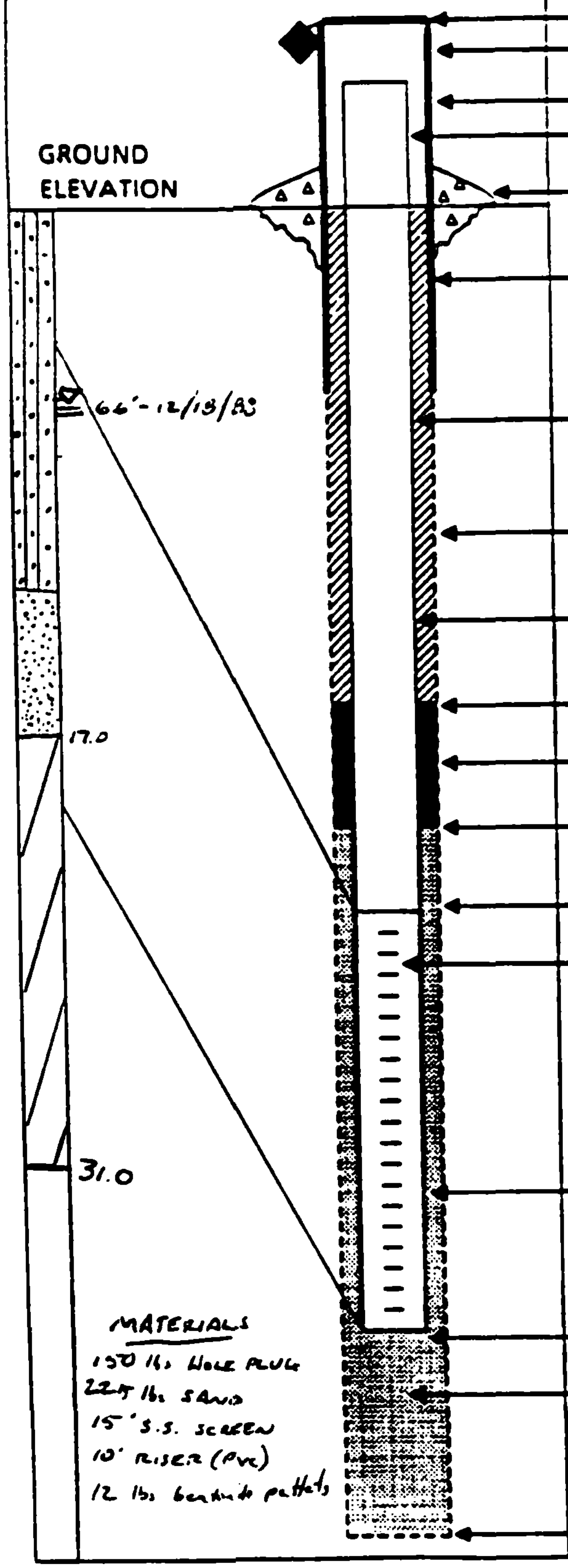

10.0
ΔH
1.0
Y
0.63 (negligible impact)
0.1
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
TIME

BORING NO.: MW501

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: Sheppard AFB	LOCATION: Wichita Falls Tx	DRILLER: W. Caldwell
PROJECT NO.: 7$63	BORING: MW501	DRILLING METHOD: Air Rotary
ELEVATION:	DATE: 12/10/88	DEVELOPMENT METHOD: Air Lift/Bailing
FIELD GEOLOGIST: P. Pogue J. Wedekind		



MATERIALS
150 lbs Hole Plug
224 lbs sand
15' S.S. screen
10' riser (PVC)
12 lbs bentonite pellets

ELEVATION OF TOP OF SURFACE CASING: ______

ELEVATION OF TOP OF RISER PIPE: ______

STICK - UP TOP OF SURFACE CASING: Flush Mount

STICK - UP RISER PIPE: -0.125

TYPE OF SURFACE SEAL: Concrete Pad

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: Steel × 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 2.5

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 3.0

ELEVATION / DEPTH TOP OF SCREEN: 4.3

TYPE OF SCREEN: Stainless Steel

SLOT SIZE x LENGTH: 0.010 × 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 Silica Sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 19.3

ELEVATION / DEPTH BOTTOM OF SAND PACK: 22.0

TYPE OF BACKFILL BELOW OBSERVATION WELL: 'Hole Plug (Bentonite Wafers) to 28'

ELEVATION / DEPTH OF HOLE: 31.0

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7S63
WELL NO: MW501
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	3
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	14.7
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	14.7
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	14.7
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	60
Yo. STARTING Y (ft) =	1.07
Yt. ENDING Y (ft) =	0.61

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.703765

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.115110

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.703765
FULLY PENETRATING. ln(Re/Rw) = 3.115110

THE CORRECT VALUE OF ln(Re/Rw) IS: 3.11511

CALCULATION

K in ft/sec = 2.31E-05

K in cm/sec = 7.03E-04

Display 5

NUS CORPORATION

WELL No.: MW-501 ELEVATION: ______ DATE: 1/13/89

STATIC WATER LEVEL 6.97 + CORRECTION 0.2 = 7.17 TIME: 1518

ELEVATION WATER ______ REFERENCE INPUT 7.17 XD: 10.87

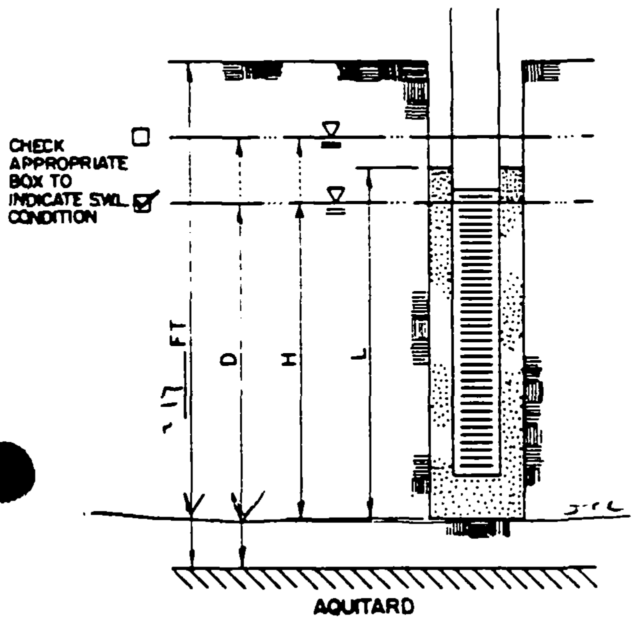
	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	8.90	
	001	0.0033	8.90	
	002	0.0067	8.89	
	003	0.0100	8.89	
	004	0.0133	8.88	
✓	005	0.0167	8.86	
	006	0.0200	8.85	
	007	0.0233	8.84	
	008	0.0267	8.84	
✓	009	0.0300	8.83	
	010	0.0333	8.83	
✓	011	0.0500	8.80	
	012	0.0667	8.77	
	013	0.0833	8.74	
✓	014	0.1000	8.71	
	015	0.1167	8.68	
	016	0.1333	8.66	
✓	017	0.1500	8.64	
	018	0.1667	8.61	
	019	0.1833	8.59	
✓	020	0.2000	8.57	
	021	0.2167	8.55	
	022	0.2333	8.53	
✓	023	0.2500	8.51	
	024	0.2667	8.49	
	025	0.2833	8.47	
✓	026	0.3000	8.45	
	027	0.3167	8.43	
✓	028	0.3333	8.41	
	029	0.4167	8.32	
✓	030	0.5000	8.24	
	031	0.5833	8.17	
✓	032	0.6667	8.11	
✓	033	0.7500	8.06	
	034	0.8333	8.01	
	035	0.9167	7.97	
✓	036	1.0000	7.94	
	037	1.0833	7.90	
	038	1.1667	7.88	
✓	039	1.2500	7.85	
	040	1.3333	7.83	
	041	1.4167	7.81	
✓	042	1.5000	7.80	
	043	1.5833	7.78	
	044	1.6667	7.77	

	Sample Number	Time (min)	
✓	045	1.7500	7.75
	046	1.8333	7.74
	047	1.9167	7.73
✓	048	2.0000	7.72
✓	049	2.5	7.66
✓	050	3.0	7.61
✓	051	3.5	7.56
✓	052	4.0	7.55
	053	4.5	7.53
✓	054	5.0	7.51
	055	5.5	7.49
✓	056	6.0	7.47
	057	6.5	7.45
✓	058	7.0	7.44
	059	7.5	7.43
	060	8.0	7.42
	061	8.5	7.41
	062	9.0	7.40
	063	9.5	7.39
	064	10.0	7.38
	065	12.0	7.35
	066	14.0	7.33
	067	16.0	7.31
	068	18.0	7.29
	069	20.0	7.28
	070	22.0	7.27
	071	24.0	
	072	26.0	
	073	28.0	
	074	30.0	
	075	32.0	
	076	34.0	
	077	36.0	
	078	38.0	
	079	40.0	
	080	42.0	
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

MW/501 pg 2

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
TEST BY/DATE: P. Pogue 1/16/89
JOB NUMBER: 7363
CALCULATED BY/DATE: J. Wedekind 2/3/89
WELL NUMBER: MW50i
CHECKED BY/DATE: [illegible]



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 7.11 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 2.87 ft. B.T.O.C.

Bott. Filter Pack = 21.87 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = -0.125 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 14.76 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 14.76 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 14.76 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = [illegible]4, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 4.36 \times 10^{-4}\ \text{cm/sec}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

<u>CONDITION #1</u>, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = NA).

A = NA B = NA (N/A if not applicable).

<u>CONDITION #2</u>, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 59.04).

C = 3.10 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 1.25 , T_t = 2.0 , Y_o = 0.67 , Y_t = 0.53

$$T = T_t - T_o = \cancel{45}\ 45 \text{ (sec)}$$

Complete Page 5 in its entirety.

BOUWER AND RICE: GROUNDWATER HYDRAULICS

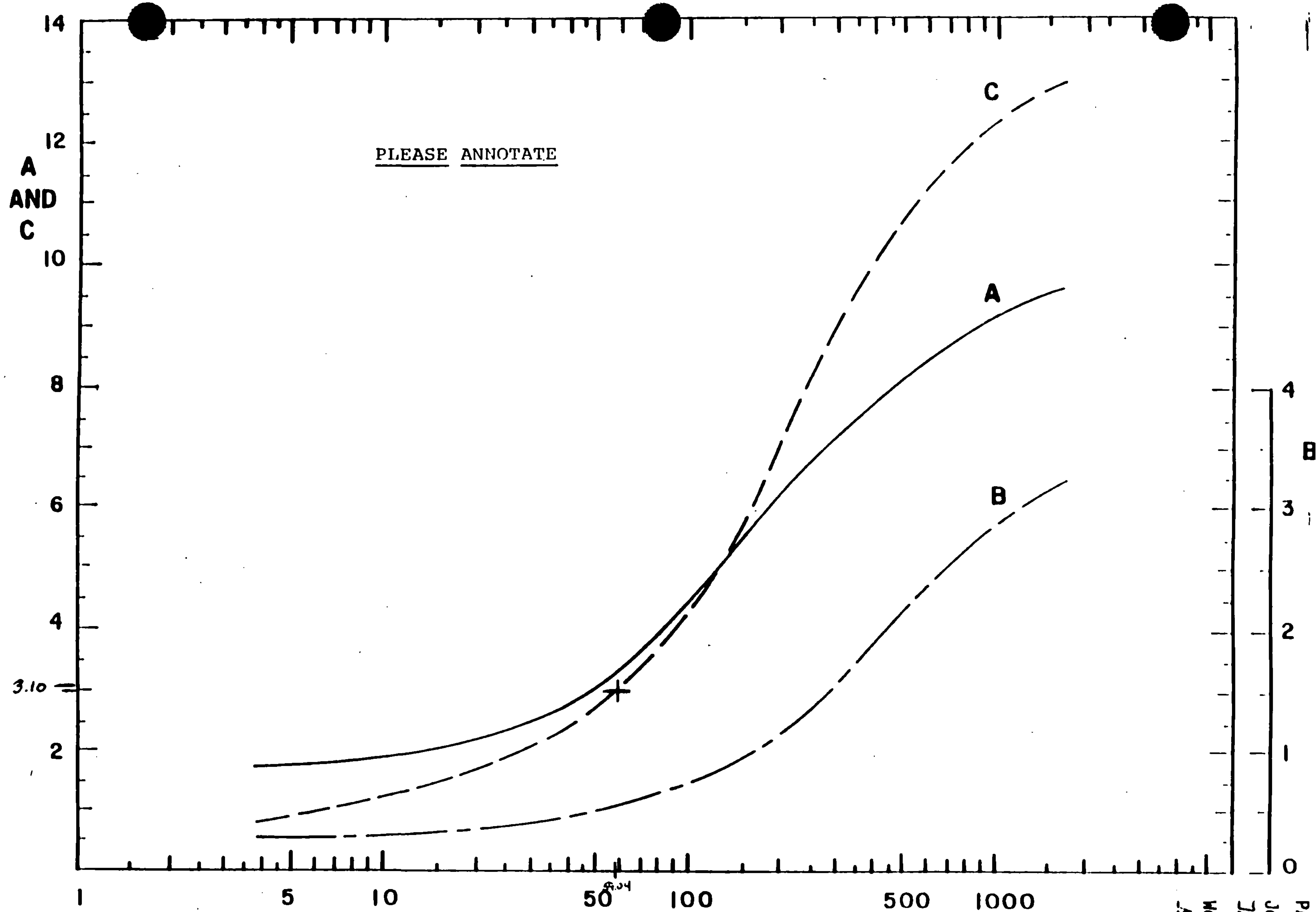


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

Job No. J&G3
Well No MW5Di

Job No. 7813
Well No. MW501

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0	S.W.L. = 7.11				
	t (min.)	y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	1.99	6.0	0.27		
	0.01	1.96	7.0	0.24		
	0.02	1.93				
	0.03	1.90				
	0.05	1.85				
	0.10	1.74				
	0.15	1.64				
	0.20	1.55				
	0.25	1.47				
	0.30	1.41				
	0.41	1.26				
	0.50	1.16				
	0.75	0.94				
	1.00	0.79				
X_o	1.25	0.69				
	1.50	0.63				
	1.75	0.57				
X_L	2.0	0.53				
	2.5	0.47				
	3.0	0.43				
	3.5	0.39				
	4.0	0.33				
	5.0	0.31				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)

B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 3.10 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 14.76

D_d = ln[(D - H)/Rw] = NA (must be ≤6)

H, Height of Well Below Water Table (ft) = 14.76

L, Height Through Which Water Enters Well (ft) = 14.76

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds (T_t - T_0) = 45

Y_0, Starting Y (ft) = 0.69

Y_t, Ending Y (ft) = 0.53

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Used bottom of filter pack as depth to impermeable boundary due to the shallow depth to clay & because the well extends into the clay.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7S63
WELL NO: MW501
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	3.1
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	14.76
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	14.76
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	14.76
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	45
Yo. STARTING Y (ft) =	0.69
Yt. ENDING Y (ft) =	0.53

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.707468

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.103348

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.707468
FULLY PENETRATING. ln(Re/Rw) = 3.103348

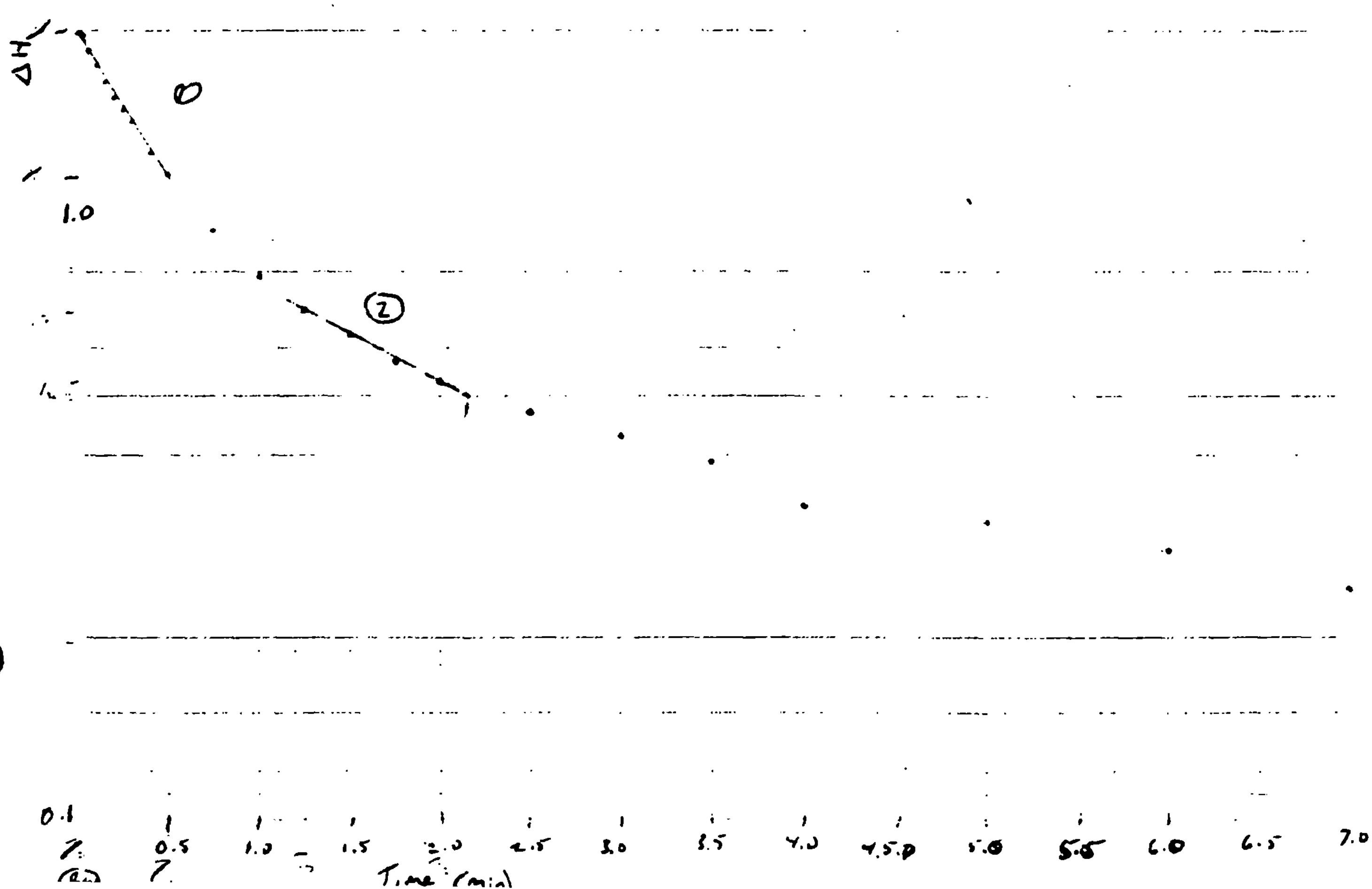
THE CORRECT VALUE OF ln(Re/Rw) IS: 3.103348

CALCULATION

K in ft/sec = 1.43E-05

K in cm/sec = 4.36E-04

7E3
MW 50i



BORING NO.: MW501

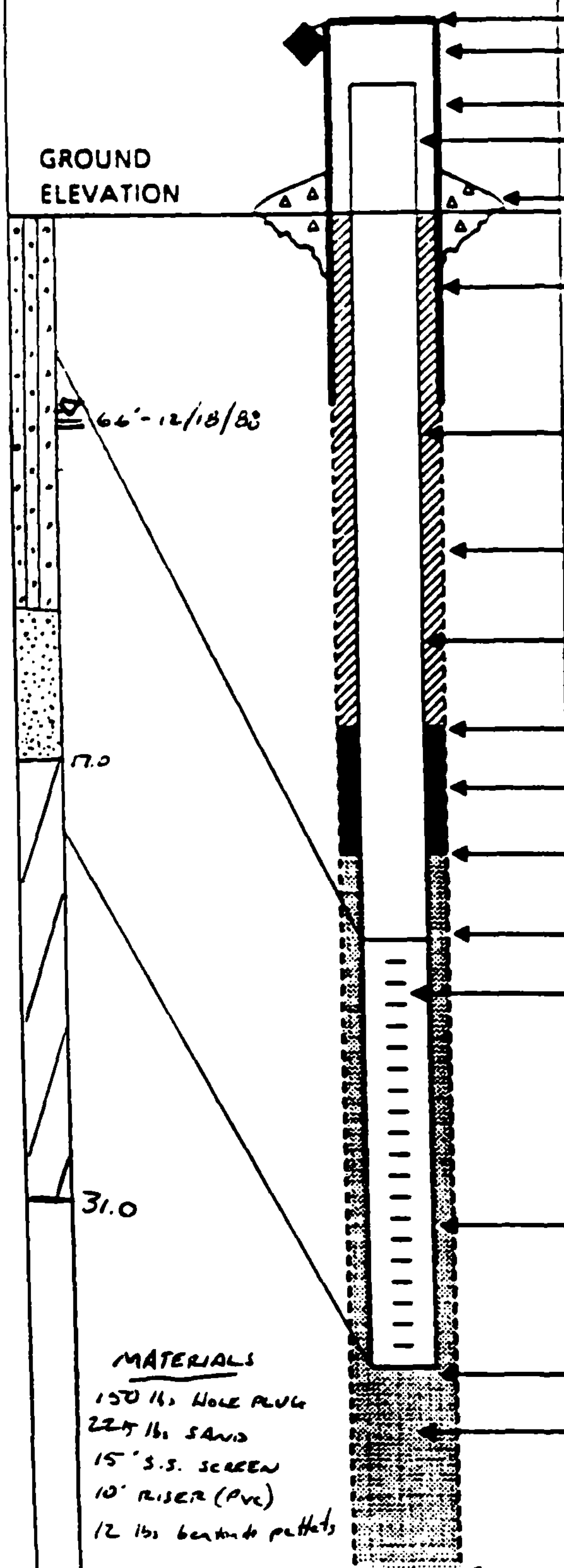
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: Sheppard AFB
LOCATION: Wichita Falls Tx
PROJECT NO.: 7$63
BORING: MW 501
ELEVATION:
DATE: 12/10/88
FIELD GEOLOGIST: P. Pogue J. Wedekind

DRILLER: W. Caldwell
DRILLING METHOD: Air Rotary
DEVELOPMENT METHOD: Air Lift/Bailing

GROUND ELEVATION



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: Flush Mount
STICK - UP RISER PIPE: -0.125
TYPE OF SURFACE SEAL: Concrete Pad
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: Steel x 5'
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 2.5
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 3.0
ELEVATION / DEPTH TOP OF SCREEN: 4.3
TYPE OF SCREEN: Stainless Steel
SLOT SIZE x LENGTH: 0.010 x 15'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 Silica Sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 19.3
ELEVATION / DEPTH BOTTOM OF SAND PACK: 22.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: 'Hole Plug (Bentonite Wafers) to 28'
ELEVATION / DEPTH OF HOLE: 31.0

MATERIALS
150 lbs Hole Plug
225 lbs Sand
15' S.S. Screen
10' Riser (PVC)
12 lbs bentonite pellets

Displays 5

NUS CORPORATION

WELL No.: MW 501 ELEVATION: ______ DATE: 1/16/89

STATIC WATER LEVEL 7.01 + CORRECTION 0.1 = 7.11 TIME: 1149

ELEVATION WATER ______ REFERENCE INPUT 7.11 XD: 9.63

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	9.10	
	001	0.0033	9.09	
	002	0.0067	9.08	
✓	003	0.0100	9.07	
	004	0.0133	9.06	
	005	0.0167	9.05	
✓	006	0.0200	9.04	
	007	0.0233	9.03	
	008	0.0267	9.02	
✓	009	0.0300	9.01	
	010	0.0333	9.00	
✓	011	0.0500	8.96	
	012	0.0667	8.92	
	013	0.0833	8.88	
✓	014	0.1000	8.85	
	015	0.1167	8.81	
	016	0.1333	8.78	
✓	017	0.1500	8.75	
	018	0.1667	8.72	
	019	0.1833	8.69	
✓	020	0.2000	8.66	
	021	0.2167	8.63	
	022	0.2333	8.61	
✓	023	0.2500	8.58	
	024	0.2667	8.56	
	025	0.2833	8.54	
✓	026	0.3000	8.52	
	027	0.3167	8.49	
	028	0.3333	8.47	
	029	0.4167	8.37	
✓	030	0.5000	8.27	
	031	0.5833	8.19	
	032	0.6667	8.12	
✓	033	0.7500	8.05	
	034	0.8333	7.99	
	035	0.9167	7.95	
✓	036	1.0000	7.90	
	037	1.0833	7.86	
	038	1.1667	7.83	
✓	039	1.2500	7.80	
	040	1.3333	7.78	
	041	1.4167	7.75	
✓	042	1.5000	7.74	
	043	1.5833	7.72	
	044	1.6667	7.70	

	Sample Number	Time (min)	
✓	045	1.7500	7.68
	046	1.8333	7.67
	047	1.9167	7.66
✓	048	2.0000	7.64
✓	049	2.5	7.58
✓	050	3.0	7.54
	051	3.5	7.50
✓	052	4.0	7.47
	053	4.5	7.44
✓	054	5.0	7.42
	055	5.5	7.40
✓	056	6.0	7.38
	057	6.5	7.37
✓	058	7.0	7.35
	059	7.5	7.34
	060	8.0	7.33
	061	8.5	7.32
	062	9.0	7.31
	063	9.5	7.30
	064	10.0	7.29
	065	12.0	7.26
	066	14.0	7.24
	067	16.0	7.21
	068	18.0	7.20
	069	20.0	7.19
	070	22.0	7.17
	071	24.0	7.17
	072	26.0	7.16
	073	28.0	7.15
	074	30.0	7.14
	075	32.0	
	076	34.0	
	077	36.0	
	078	38.0	
	079	40.0	
	080	42.0	
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB

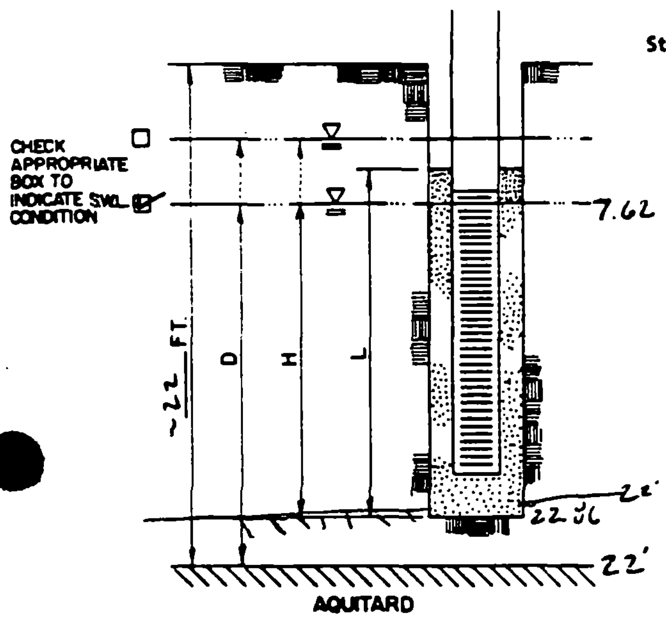
JOB NUMBER: 7$63

WELL NUMBER: MW ~~30~~ (GW) 502

TEST BY/DATE: P. Pgue 1/13/89

CALCULATED BY/DATE: J. Wedekind 2/11/89

CHECKED BY/DATE: J Lirris 4/24/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 7.62 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 4.86 ft. B.T.O.C.

Bott. Filter Pack = 22.86 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 0.14 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 15.24 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 15.24 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 15.24 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = NA, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 4.47 \times 10^{-4}\ cm/sec}$

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = ______).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 60.96).

C = 3.2 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 1.08 , T_t = 1.75 , Y_o = 0.82 , Y_t = 0.64

$$T = T_t - T_o = 40.2 \text{ (sec)}$$

Complete Page 5 in its entirety.

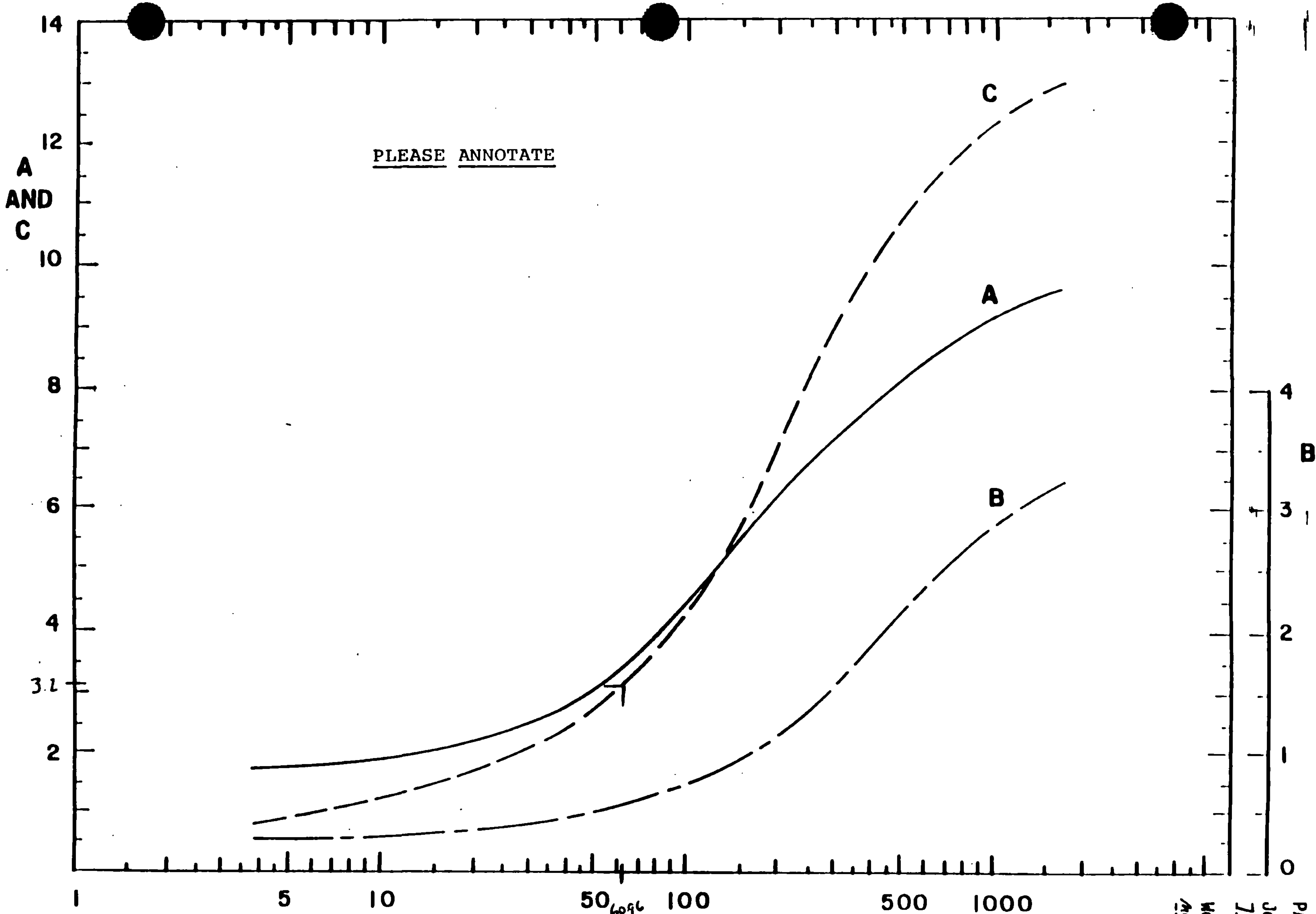


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

Job No. 7563
Well No. MW502

PLOT y versus t (from field data, attached at back):

where:

- t = time measured in field during slug test
- y = depth to static water table minus depth to falling water level (for slug injection)

or

- y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

t = 0 t (min.)	S.W.L. = 7.62 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
0.00	2.08	3.0	0.49		
0.30	2.02	4.0	0.42		
0.50	1.97	5.0	0.36		
0.10	1.87	6.0	0.32		
0.15	1.76	7.0	0.28		
0.20	1.67				
0.25	1.58				
0.30	1.50				
0.42	1.34				
0.50	1.24				
0.58	1.15				
0.75	1.00				
0.83	0.95				
1.00	0.86				
T_o — 1.08	0.82 — y_o				
1.16	0.79				
1.25	0.76				
1.33	0.74				
1.50	0.70				
1.58	0.68				
T_t — 1.75	0.64 — y_t				
2.0	0.61				
2.5	0.54				

Job No. 7~~[illegible]~~7863
Well No. MW502

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)
B (from chart) = NA (N/A if not applicable)

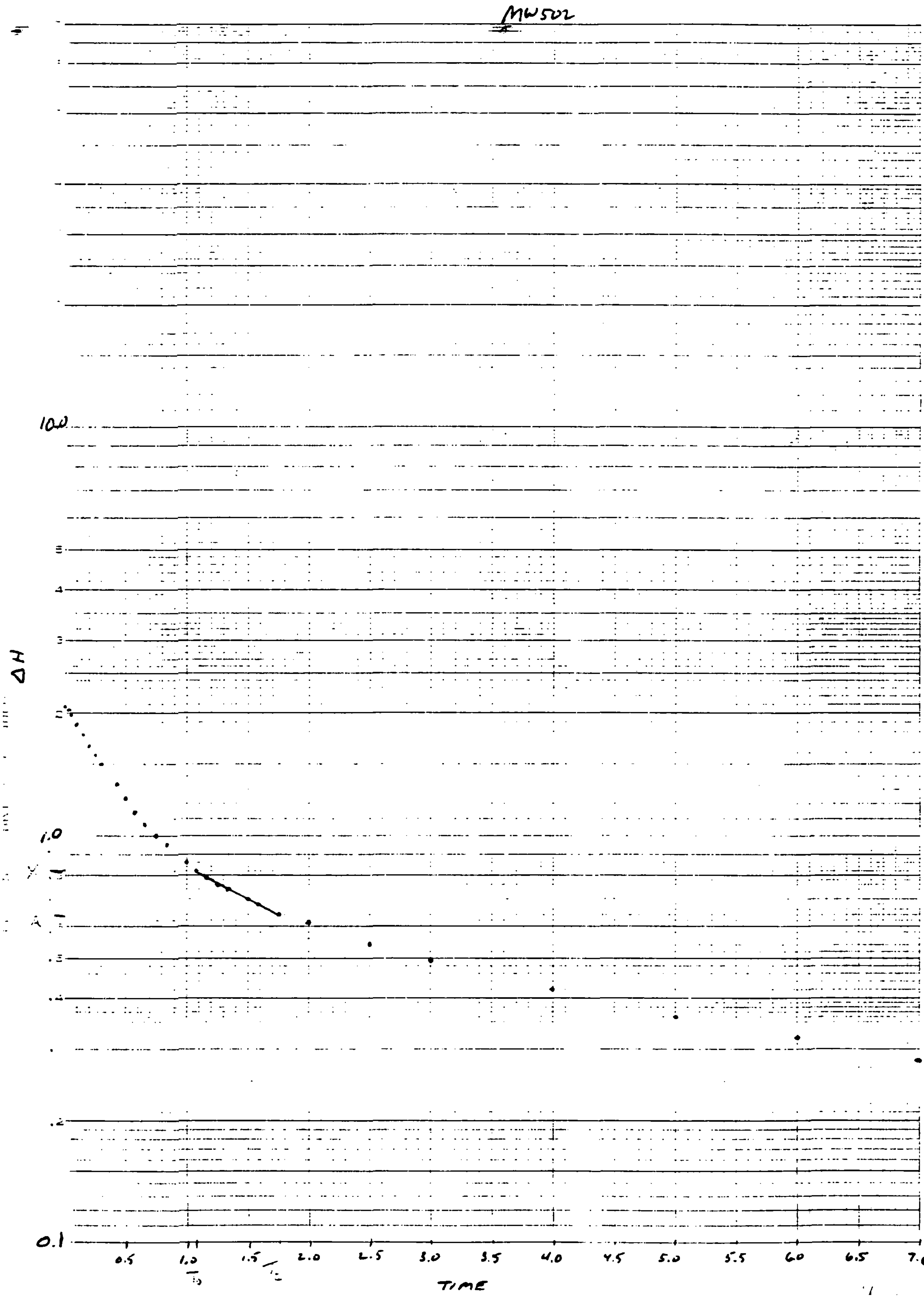
FULLY PENETRATING WELL:

C (from chart) = 3.2 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 15.24
D_d = ln[(D - H)/Rw] = NA (must be ≤6)
H, Height of Well Below Water Table (ft) = 15.24
L, Height Through Which Water Enters Well (ft) = 15.24
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 40.2
Y_o, Starting Y (ft) = 0.82
Y_t, Ending Y (ft) = 0.64

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.



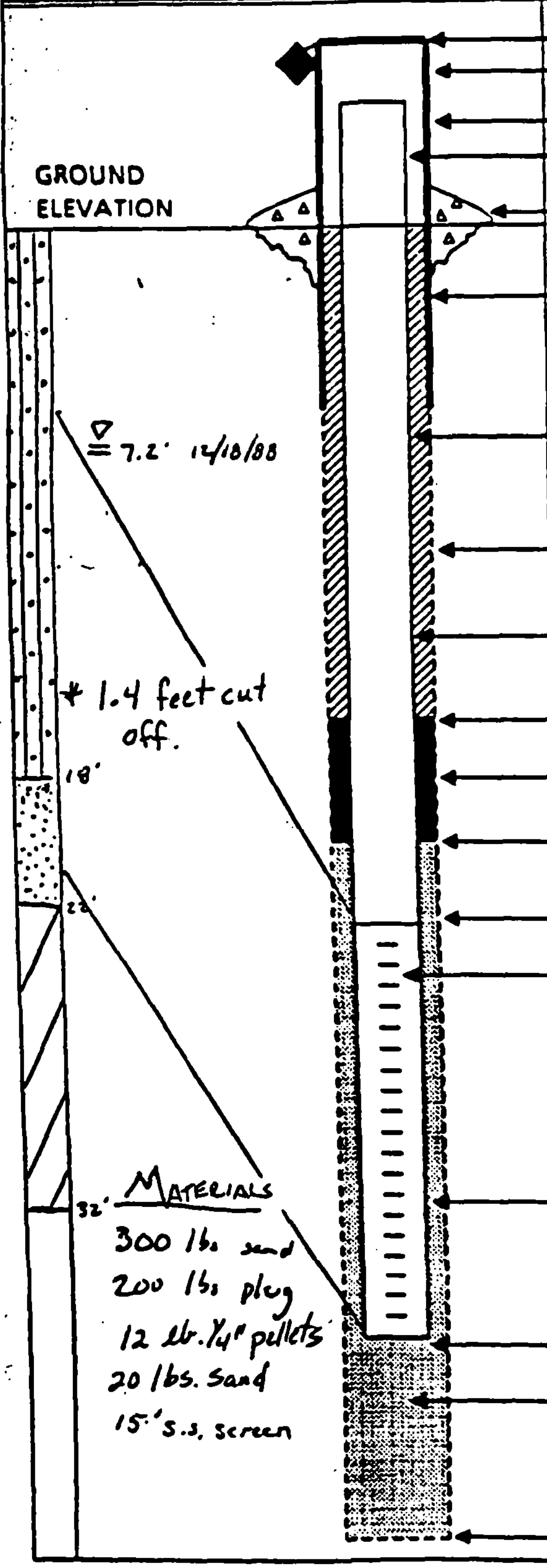
MW502
100
1.0
ΔH
0.1
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
TIME

BORING NO.: MW502

NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT SAFB	LOCATION Wichita Falls Tx	DRILLER W. Caldwell
PROJECT NO. 7$63	BORING MW502	DRILLING METHOD Air Rotary
ELEVATION	DATE 12-10-88	DEVELOPMENT METHOD Air Lift
FIELD GEOLOGIST -J. Wedekind, D. Pogue		



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: flush mount

STICK - UP RISER PIPE: -0.14

TYPE OF SURFACE SEAL: Concrete Pad

I.D. OF SURFACE CASING: 6

TYPE OF SURFACE CASING: Steel

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 4

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 5

ELEVATION / DEPTH TOP OF SCREEN: 6

TYPE OF SCREEN: Stainless Steel

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 Silica Sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 21

ELEVATION / DEPTH BOTTOM OF SAND PACK: 23

TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug (Bentonite)

ELEVATION / DEPTH OF HOLE: 32

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW502
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	3.2
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	15.24
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	15.24
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	15.24
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	40.2
Yo. STARTING Y (ft) =	0.82
Yt. ENDING Y (ft) =	0.64

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.736561

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.123836

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.736561
FULLY PENETRATING. ln(Re/Rw) = 3.123836

THE CORRECT VALUE OF ln(Re/Rw) IS: 3.123836

CALCULATION

K in ft/sec = 1.47E-05

K in cm/sec = 4.47E-04

Display 4.

NUS CORPORATION

WELL No.: MW-502 ELEVATION: ______ DATE: 1/13/89

STATIC WATER LEVEL 7.42 + CORRECTION 0.2 = 7.62 TIME 1435

ELEVATION WATER ______ REFERENCE INPUT 7.62 XD: 12.63

12.63 + 7.62 = 20.25

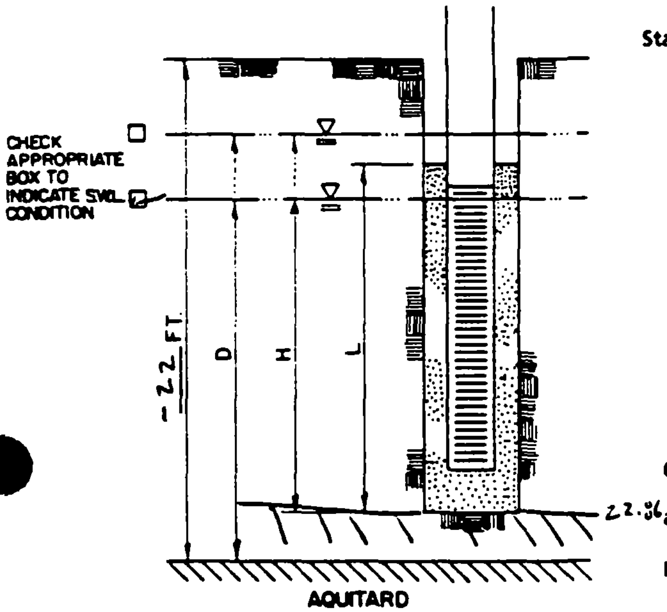
	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	9.70	
	001	0.0033	9.69	
	002	0.0067	9.69	
	003	0.0100	9.67	
	004	0.0133	9.67	
	005	0.0167	9.67	
	006	0.0200	9.65	
	007	0.0233	9.65	
	008	0.0267	9.64	
✓	009	0.0300	9.64	
	010	0.0333	9.63	
✓	011	0.0500	9.59	
	012	0.0667	9.56	
	013	0.0833	9.52	
✓	014	0.1000	9.49	
	015	0.1167	9.44	
	016	0.1333	9.41	
✓	017	0.1500	9.38	
	018	0.1667	9.34	
	019	0.1833	9.31	
✓	020	0.2000	9.29	
	021	0.2167	9.26	
	022	0.2333	9.23	
✓	023	0.2500	9.20	
	024	0.2667	9.18	
	025	0.2833	9.15	
✓	026	0.3000	9.12	
	027	0.3167	9.10	
	028	0.3333	9.08	
✓	029	0.4167	8.96	
✓	030	0.5000	8.86	
✓	031	0.5833	8.77	
✓	032	0.6667	8.69	
✓	033	0.7500	8.62	
✓	034	0.8333	8.57	
	035	0.9167	8.52	
✓	036	1.0000	8.48	
✓	037	1.0833	8.44	
✓	038	1.1667	8.41	
✓	039	1.2500	8.38	
✓	040	1.3333	8.36	
	041	1.4167	8.34	
✓	042	1.5000	8.32	
✓	043	1.5833	8.30	
	044	1.6667	8.28	

Sample Number	Time (min)	
045	1.7500	8.26
046	1.8333	8.25
047	1.9167	8.24
048	2.0000	8.23
049	2.5	8.16
050	3.0	8.11
051	3.5	8.07
052	4.0	8.04
053	4.5	8.01
054	5.0	7.98
055	5.5	7.96
056	6.0	7.94
057	6.5	7.92
058	7.0	7.90
059	7.5	7.89
060	8.0	7.87
061	8.5	7.86
062	9.0	7.85
063	9.5	7.84
064	10.0	7.83
065	12.0	7.79
066	14.0	7.76
067	16.0	7.74
068	18.0	7.73
069	20.0	7.72
070	22.0	7.70
071	24.0	
072	26.0	
073	28.0	
074	30.0	
075	32.0	
076	34.0	
077	36.0	
078	38.0	
079	40.0	
080	42.0	
081	44.0	
082	46.0	
083	48.0	
084	50.0	
085	52.0	
086	54.0	
087	56.0	
088	58.0	
089	60.0	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
JOB NUMBER: 7563
WELL NUMBER: MW 502

TEST BY/DATE: P. Pogue 1/16/89
CALCULATED BY/DATE: J. Wedekind 2/6/89
CHECKED BY/DATE: J. [illegible] 2/24/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 7.38 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 4.86 ft. B.T.O.C.

Bott. Filter Pack = 22.86 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = -0.14 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 15.48 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 15.48 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 15.48 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = NA, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

4.42×10^{-4}

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

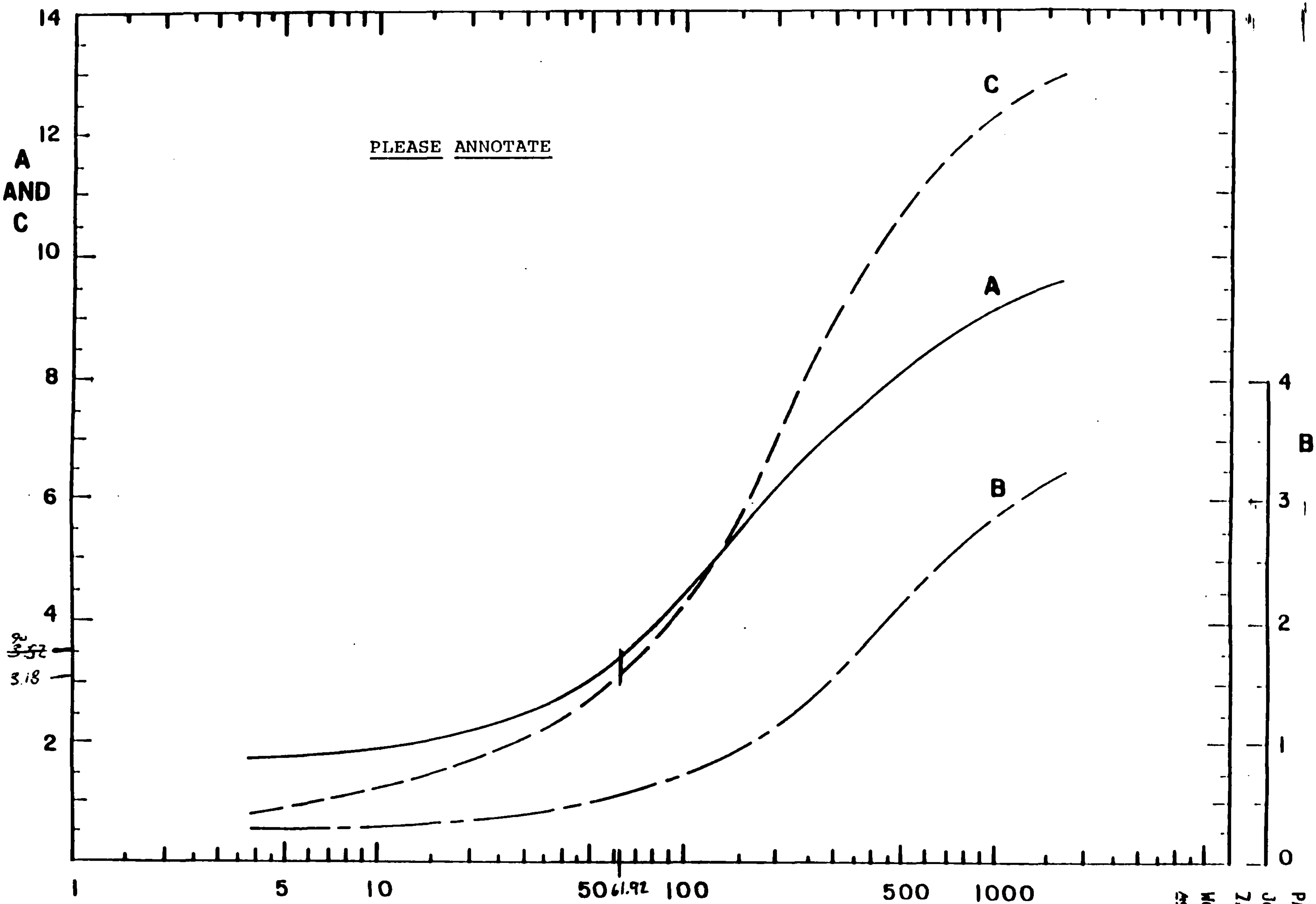


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

PAGE 3
Job No.
Well No

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

t = 0 / t (min.)	S.W.L. = 7.38 / y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
0.00	2.01	4.0	0.43		
0.03	1.95	5.0	0.37		
0.05	1.91	6.0	0.33		
0.10	1.80	7.0	0.29		
0.15	1.71				
0.20	1.62				
0.25	1.54				
0.30	1.47				
0.41	1.31				
0.50	1.22				
0.58	1.14				
0.75	1.01				
0.83	0.96				
1.00	0.87				
1.16	0.81				
1.25	0.78				
1.41	0.73				
1.50	0.72				
1.66	0.68				
1.75	0.66				
2.00	0.62				
2.50	0.56				
3.0	0.50				

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = NA).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 61.92).

C = 3.18 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_0, Y_0 (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_0 = 1.00, T_t = 1.75, Y_0 = 0.87, Y_t = 0.66

$$T = T_t - T_o = 45 \text{ (sec)}$$

Complete Page 5 in its entirety.

Job No. 7863
Well No. MW502

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)
B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 3.18 (N/A if not applicable)

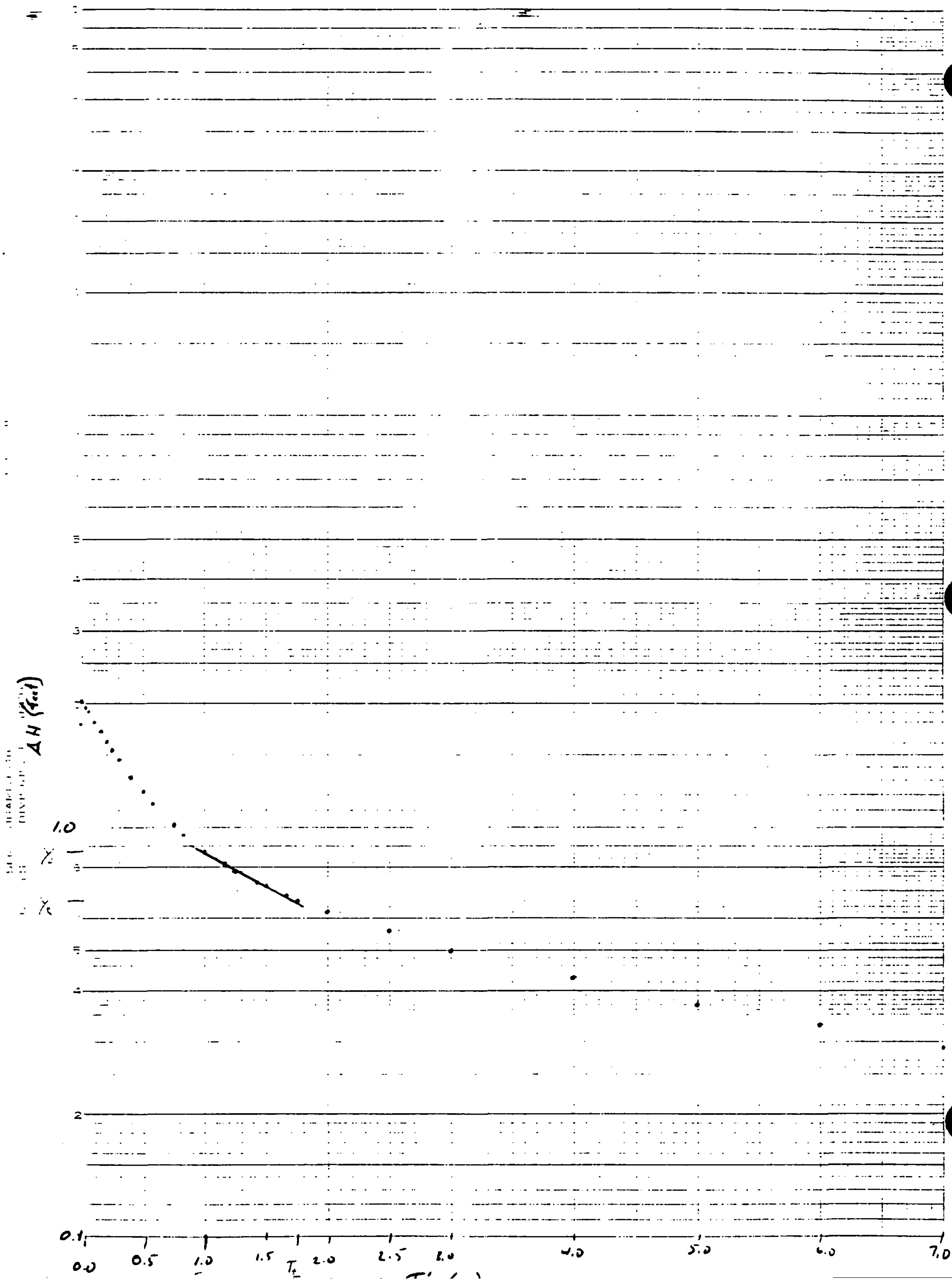
D, Depth to Impermeable Boundary (ft) = 15.48
D_d = ln[(D - H)/Rw] = ________ (must be ≤6)
H, Height of Well Below Water Table (ft) = 15.48
L, Height Through Which Water Enters Well (ft) = 15.48
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 45
Y_o, Starting Y (ft) = 0.87
Y_t, Ending Y (ft) = 0.66

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Chose bottom of filter pack as aquitard. Well was set in 0.86' into clay layer.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.

MW5U2



BORING NO.: MW502

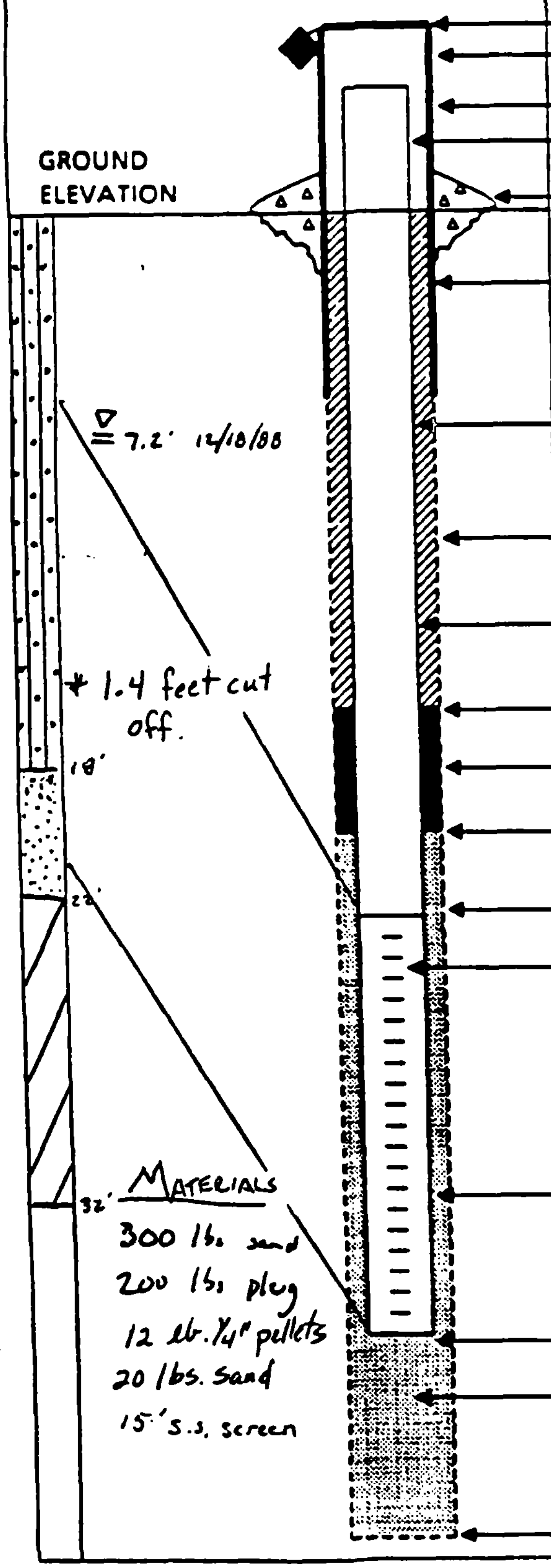
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT SAFB
PROJECT NO. 7$63
ELEVATION
FIELD GEOLOGIST J. WEDEKIND D. POGUE

LOCATION WICHITA FALLS, TX
BORING MW502
DATE 12-10-88

DRILLER W. CALDWELL
DRILLING METHOD AIR ROTARY
DEVELOPMENT METHOD AIR LIFT



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: Flush mount
STICK - UP RISER PIPE: -0.14
TYPE OF SURFACE SEAL: CONCRETE PAD
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: VOLCLAY GROUT
ELEVATION / DEPTH TOP OF SEAL: 4
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 5
ELEVATION / DEPTH TOP OF SCREEN: 6
TYPE OF SCREEN: STAINLESS STEEL
SLOT SIZE x LENGTH: 0.010" x 15'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 21
ELEVATION / DEPTH BOTTOM OF SAND PACK: 23
TYPE OF BACKFILL BELOW OBSERVATION WELL: 'HOLE PLUG (BENTONITE)
ELEVATION / DEPTH OF HOLE: 32

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7S63
WELL NO: MW502
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	3.18
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	15.48
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	15.48
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	15.48
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	45
Yo. STARTING Y (ft) =	0.87
Yt. ENDING Y (ft) =	0.66

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.750766

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.144963

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.750766
FULLY PENETRATING. ln(Re/Rw) = 3.144963

THE CORRECT VALUE OF ln(Re/Rw) IS: 3.144963

CALCULATION

K in ft/sec = 1.45E-05

K in cm/sec = 4.42E-04

Display Co

NUS CORPORATION

WELL No.: MW502 ELEVATION: ______ DATE: 1/16/89

STATIC WATER LEVEL 7.28 + CORRECTION 0.1 = 7.38 TIME: 13:4

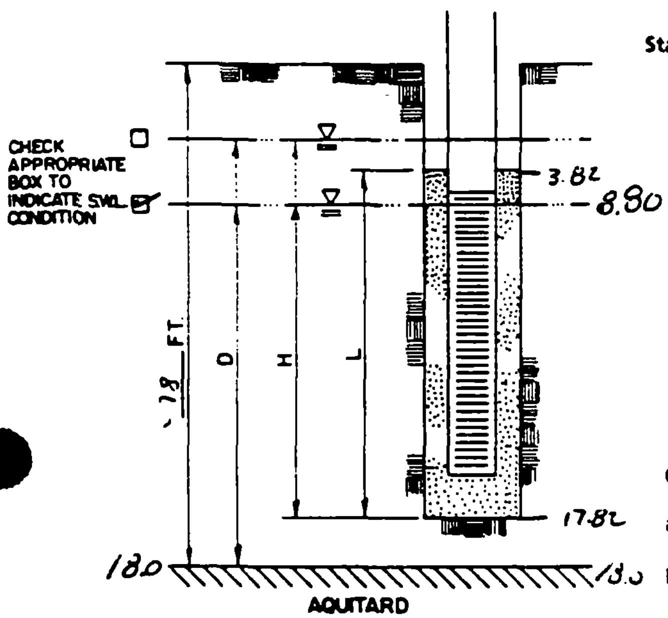
ELEVATION WATER ______ REFERENCE INPUT 7.38 XD: 12.52

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	9.39	
	001	0.0033	9.38	
	002	0.0067	9.38	
	003	0.0100	9.37	
	004	0.0133	9.36	
	005	0.0167	9.36	
	006	0.0200	9.35	
	007	0.0233	9.34	
	008	0.0267	9.34	
✓	009	0.0300	9.33	
	010	0.0333	9.32	
✓	011	0.0500	9.29	
	012	0.0667	9.25	
	013	0.0833	9.22	
✓	014	0.1000	9.18	
	015	0.1167	9.15	
	016	0.1333	9.12	
✓	017	0.1500	9.09	
	018	0.1667	9.06	
	019	0.1833	9.03	
✓	020	0.2000	9.00	
	021	0.2167	8.97	
	022	0.2333	8.95	
✓	023	0.2500	8.92	
	024	0.2667	8.90	
	025	0.2833	8.87	
✓	026	0.3000	8.85	
	027	0.3167	8.82	
	028	0.3333	8.80	
✓	029	0.4167	8.69	
✓	030	0.5000	8.60	
✓	031	0.5833	8.52	
	032	0.6667	8.45	
✓	033	0.7500	8.39	
✓	034	0.8333	8.34	
✓ 67	035	0.9167	8.29	
✓	036	1.0000	8.25	
	037	1.0833	8.22	
✓	038	1.1667	8.19	
✓	039	1.2500	8.16	
	040	1.3333	8.14	
✓	041	1.4167	8.11	
✓	042	1.5000	8.10	
	043	1.5833	8.08	
83 ✓	044	1.6667	8.06	

	Sample Number	Time (min)	
✓	045	1.7500	8.04
	046	1.8333	8.03
	047	1.9167	8.02
✓	048	2.0000	8.00
✓	049	2.5	7.94
✓	050	3.0	7.88
	051	3.5	7.84
✓	052	4.0	7.81
	053	4.5	7.78
✓	054	5.0	7.75
	055	5.5	7.73
✓	056	6.0	7.71
	057	6.5	7.69
✓	058	7.0	7.67
	059	7.5	7.66
	060	8.0	7.64
	061	8.5	7.63
	062	9.0	7.62
	063	9.5	7.61
	064	10.0	7.60
	065	12.0	7.56
	066	14.0	7.53
	067	16.0	7.52
	068	18.0	7.50
	069	20.0	7.48
	070	22.0	7.47
	071	24.0	7.46
	072	26.0	7.45
	073	28.0	7.45
	074	30.0	7.44
	075	32.0	7.43
	076	34.0	7.43
	077	36.0	7.42
	078	38.0	
	079	40.0	
	080	42.0	
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
JOB NUMBER: 7$63
WELL NUMBER: MW52
TEST BY/DATE: P. Pogue / J. Wedekind 1/13/89
CALCULATED BY/DATE: J. Wedekind 2/6/89
CHECKED BY/DATE: J. [signature] 4/24/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 8.80 ft. (below top of casing)

JCL 4.82 B.T.O.C.

Top Filter Pack = ~~3.82~~ ft. B.T.O.C.

Bott. Filter Pack = 17.82 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = -0.18 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 9.02 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 9.02 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = ~~8.70~~ 9.20 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = -0.33, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 2.88 \times 10^{-3}\ \text{cm/sec}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = ____).
A = N/A B = N/A (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 36.08).
C = 2.22 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.41, T_t = 0.66, Y_o = 0.60, Y_t = 0.40

$$T = T_t - T_o = 15 \text{ (sec)}$$

Complete Page 5 in its entirety.

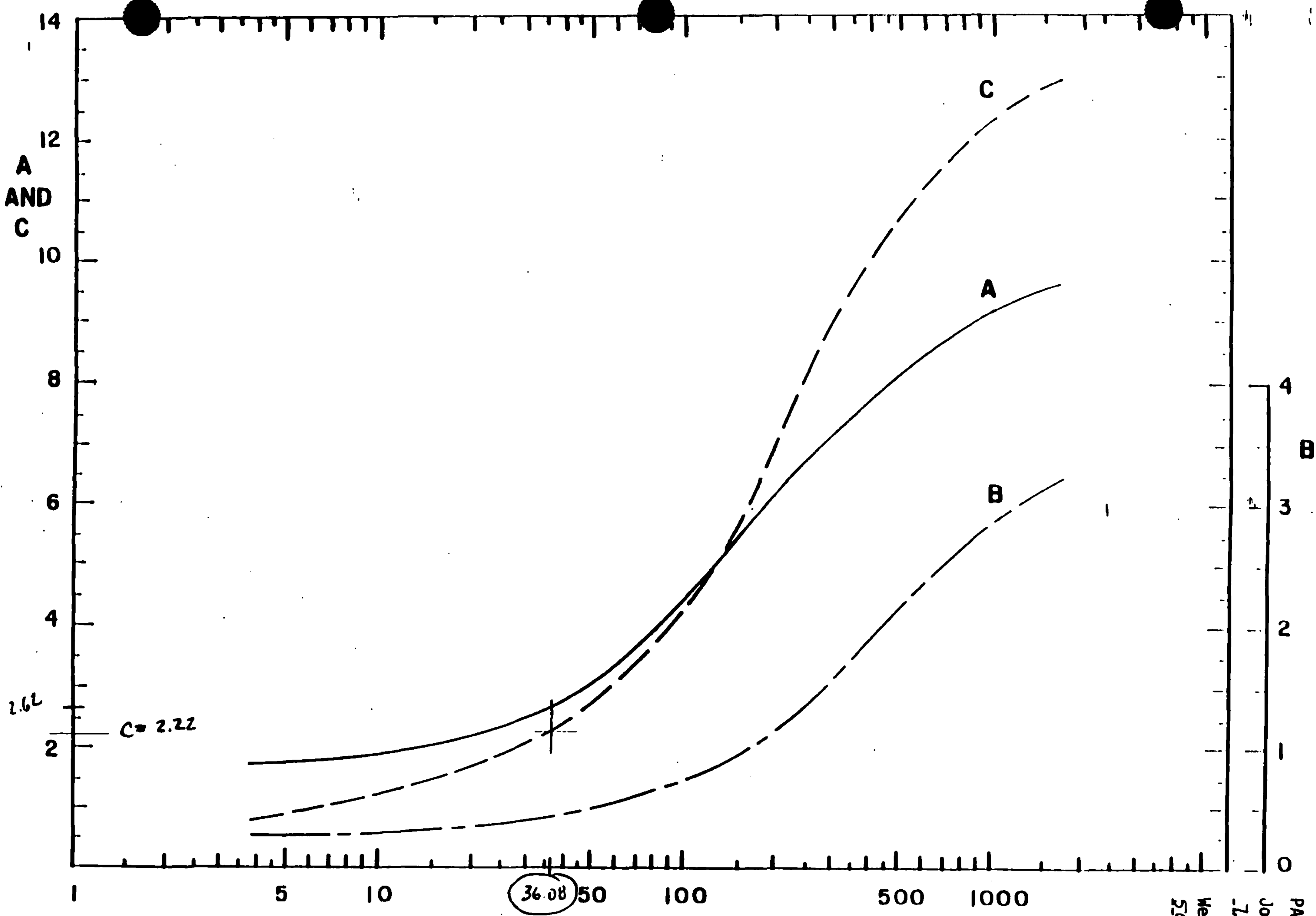


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

PAGE 3
Job No. 7263
Well No 503

Job No. 7563
Well No. 503

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 8.80 y (feet)
	0.00	1.69
	0.01	1.63
	0.02	1.58
	0.03	1.52
	0.05	1.43
	0.10	1.24
	0.15	1.09
	0.20	0.96
	0.25	0.85
	0.30	0.76
	0.32	0.73
	0.33	0.71
X_o –	0.41	0.60
	0.50	0.51
	0.58	0.45
X_t –	0.66	0.40
	0.75	0.36
	1.0	0.28
	1.25	0.22
	1.50	0.18
	2.0	0.14
	3.0	0.09

t (min.)	y (feet)

t (min.)	y (feet)

Job No. 7863
Well No. 503

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = N/A (N/A if not applicable)
B (from chart) = N/A (N/A if not applicable)

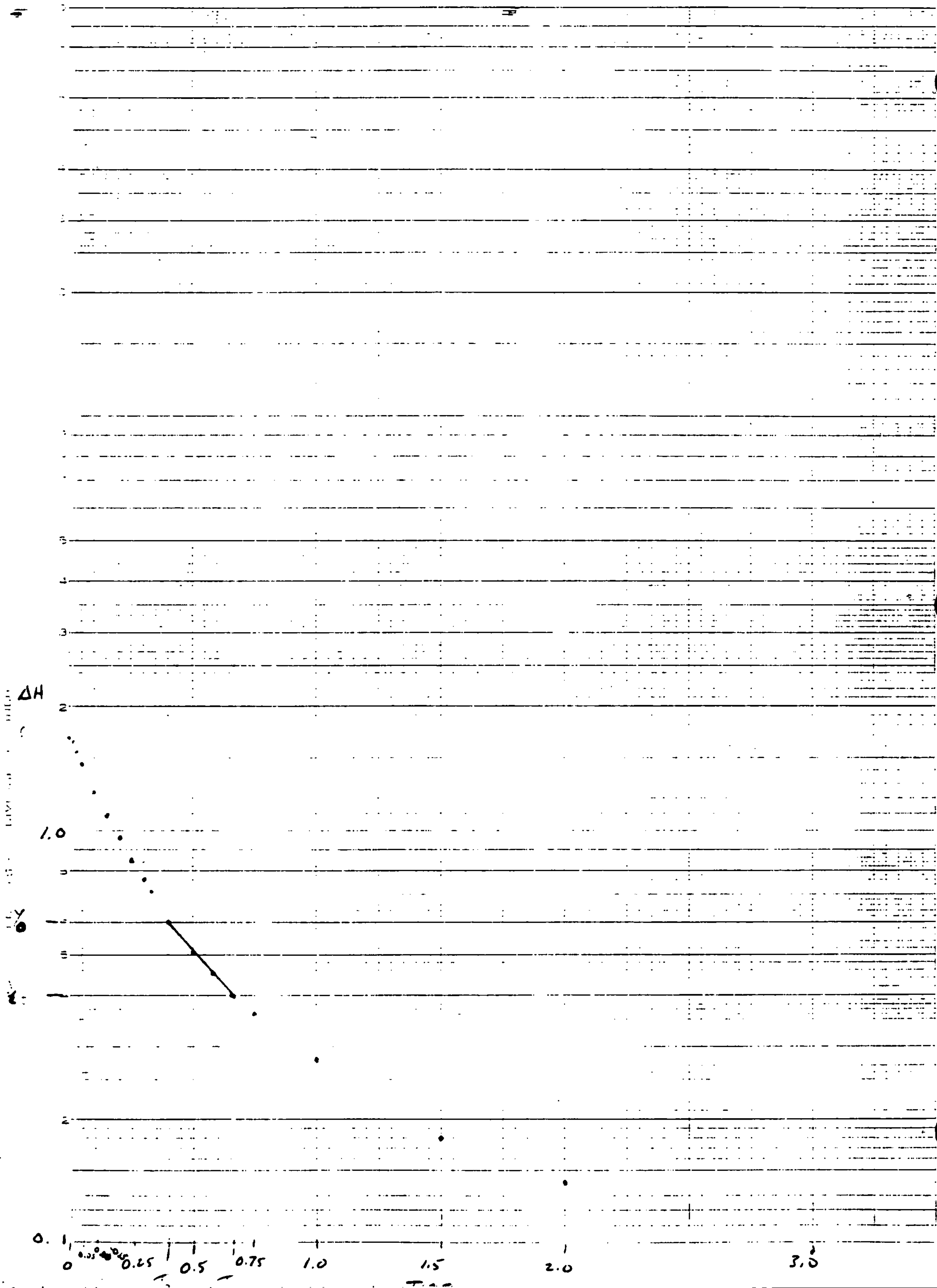
FULLY PENETRATING WELL:

C (from chart) = 2.22 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 9.20
D_d = ln[(D - H)/Rw] = -0.33 (must be ≤ 6)
H, Height of Well Below Water Table (ft) = 9.02
L, Height Through Which Water Enters Well (ft) = 9.02
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds ($T_t - T_o$) = 15
Y_o, Starting Y (ft) = 0.60
Y_t, Ending Y (ft) = 0.40

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Used 18.0' for depth to aquitard - not 17.82 because using the same number makes $\frac{D-H}{Rw} = 0$.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.


ΔH
1.0
0.1
0
0.25
0.5
0.75
1.0
1.5
2.0
3.0

BORING NO.: MW503

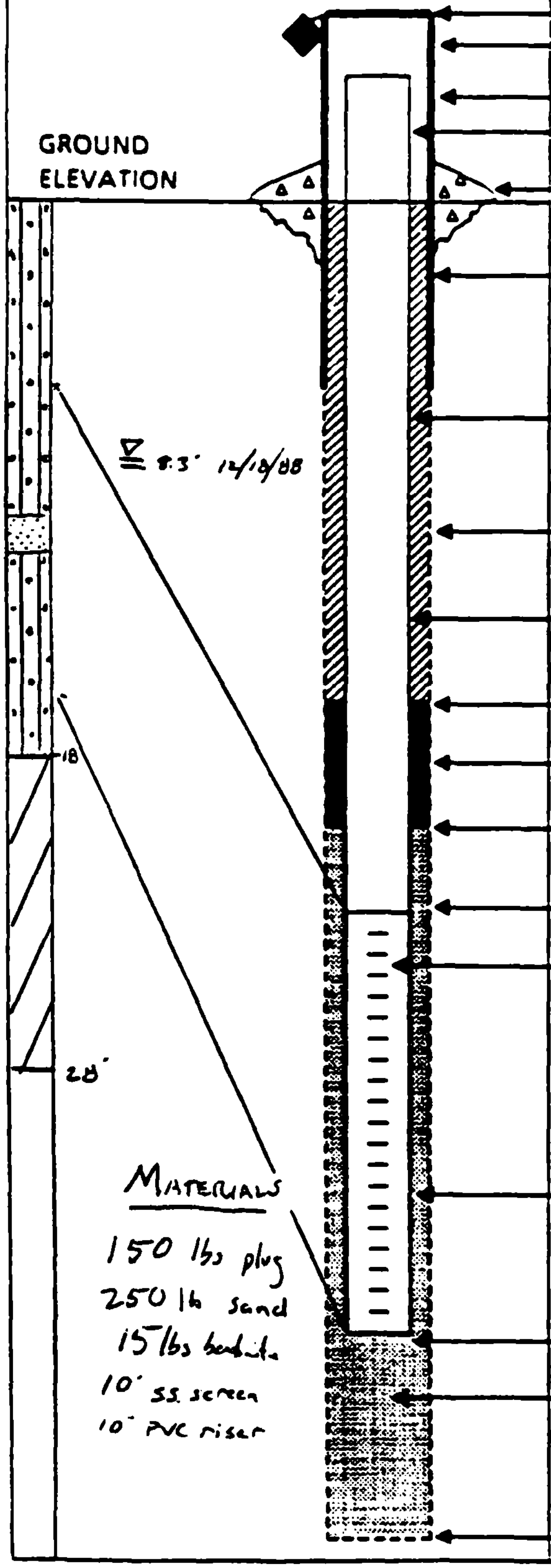
NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: SHEPPARD AFB
PROJECT NO.: 7763
ELEVATION:
FIELD GEOLOGIST: R Pogue

LOCATION: Wichita Falls TX
BORING: MW 503
DATE: 12/10/88

DRILLER: W Caldwell
DRILLING METHOD: Air Rotary
DEVELOPMENT METHOD: Air Lift



MATERIALS
150 lbs plug
250 lb sand
15 lbs bentonite
10' SS screen
10' PVC riser

ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: FLUSH MOUNT
STICK - UP RISER PIPE: -0.18'
TYPE OF SURFACE SEAL: Concrete pad
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: Volclay Grout
ELEVATION / DEPTH TOP OF SEAL: 4'
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 5'
ELEVATION / DEPTH TOP OF SCREEN: 6'
TYPE OF SCREEN: Stainless Steel
SLOT SIZE x LENGTH: 0.010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: 20-40 silica sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 16'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 18'
TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug - Bentonite
ELEVATION / DEPTH OF HOLE: 28

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW503
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	2.22
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	9.2
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	9.02
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	9.02
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	15
Yo. STARTING Y (ft) =	0.6
Yt. ENDING Y (ft) =	0.4

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.259762

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.715172

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.259762
FULLY PENETRATING. ln(Re/Rw) = 2.715172

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.715172

CALCULATION

K in ft/sec = 9.45E-05

K in cm/sec = 2.88E-03

Display 3

NUS CORPORATION

WELL No.: MW 503 ELEVATION: ______ DATE: 1/13/89

STATIC WATER LEVEL 8.60 + CORRECTION ~~8.80~~ .20 = 8.80 TIME: 1352

ELEVATION WATER ______ REFERENCE INPUT 8.80 XD: 6.33

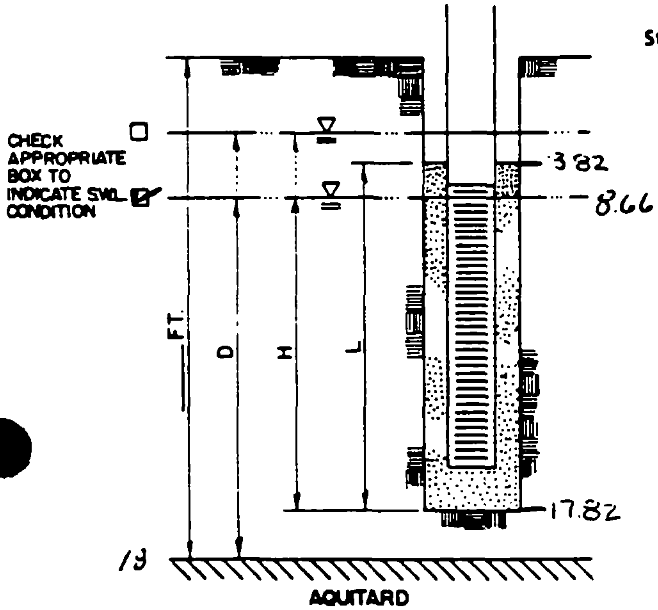
6.33 + 8.60 = 15.13

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	10.49	
	001	0.0033	10.49	
	002	0.0067	10.45	
✓	003	0.0100	10.43	
	004	0.0133	10.41	
	005	0.0167	10.39	
✓	006	0.0200	10.38	
	007	0.0233	10.36	
80	008	0.0267	10.34	
✓	009	0.0300	10.32	
	010	0.0333	10.31	
✓	011	0.0500	10.23	
	012	0.0667	10.16	
	013	0.0833	10.10	
✓	014	0.1000	10.04	
	015	0.1167	9.99	
	016	0.1333	9.94	
✓	017	0.1500	9.89	
	018	0.1667	9.84	
	019	0.1833	9.80	
✓	020	0.2000	9.76	
	021	0.2167	9.72	
	022	0.2333	9.69	
✓	023	0.2500	9.65	
	024	0.2667	9.62	
	025	0.2833	9.59	
✓	026	0.3000	9.56	
	027	0.3167	9.53	
✓	028	0.3333	9.51	
✓	029	0.4167	9.40	
✓	030	0.5000	9.31	
✓	031	0.5833	9.25	
✓	032	0.6667	9.20	
✓	033	0.7500	9.16	
	034	0.8333	9.13	
	035	0.9167	9.10	
✓	036	1.0000	9.08	
	037	1.0833	9.05	
	038	1.1667	9.04	
✓	039	1.2500	9.02	
	040	1.3333	9.01	
	041	1.4167	9.00	
✓	042	1.5000	8.98	
	043	1.5833	8.97	
	044	1.6667	8.96	

Sample Number	Time (min)	
045	1.7500	8.96
046	1.8333	8.95
047	1.9167	8.94
048	2.0000	8.94
049	2.5	8.91
050	3.0	8.89
051	3.5	8.87
052	4.0	8.86
053	4.5	8.86
054	5.0	8.85
055	5.5	8.85
056	6.0	8.84
057	6.5	8.84
058	7.0	8.83
059	7.5	8.83
060	8.0	8.83
061	8.5	8.83
062	9.0	8.83
063	9.5	8.82
064	10.0	8.82
065	12.0	8.81
066	14.0	8.81
067	16.0	8.80
068	18.0	
069	20.0	
070	22.0	
071	24.0	
072	26.0	
073	28.0	
074	30.0	
075	32.0	
076	34.0	
077	36.0	
078	38.0	
079	40.0	
080	42.0	
081	44.0	
082	46.0	
083	48.0	
084	50.0	
085	52.0	
086	54.0	
087	56.0	
088	58.0	
089	60.0	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
TEST BY/DATE: P. Pyuc / J. Wedekind 1/13/89
JOB NUMBER: 7563
CALCULATED BY/DATE: J. Wedekind 2/6/89
WELL NUMBER: MW503
CHECKED BY/DATE: J. Carter 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 8.66 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 3.82 ft. B.T.O.C.

Bott. Filter Pack = 17.82 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = -0.18 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 9.16 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 9.16 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 9.34 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = -0.33, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{7.84 \times 10^{-4} \text{ cm/sec}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = ____).

A = N/A B = N/A (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 36.64).

C = 2.30 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 1.00, T_t = 2.00, Y_o = 0.36, Y_t = 0.23

$$T = T_t - T_o = 60 \text{ (sec)}$$

Complete Page 5 in its entirety.

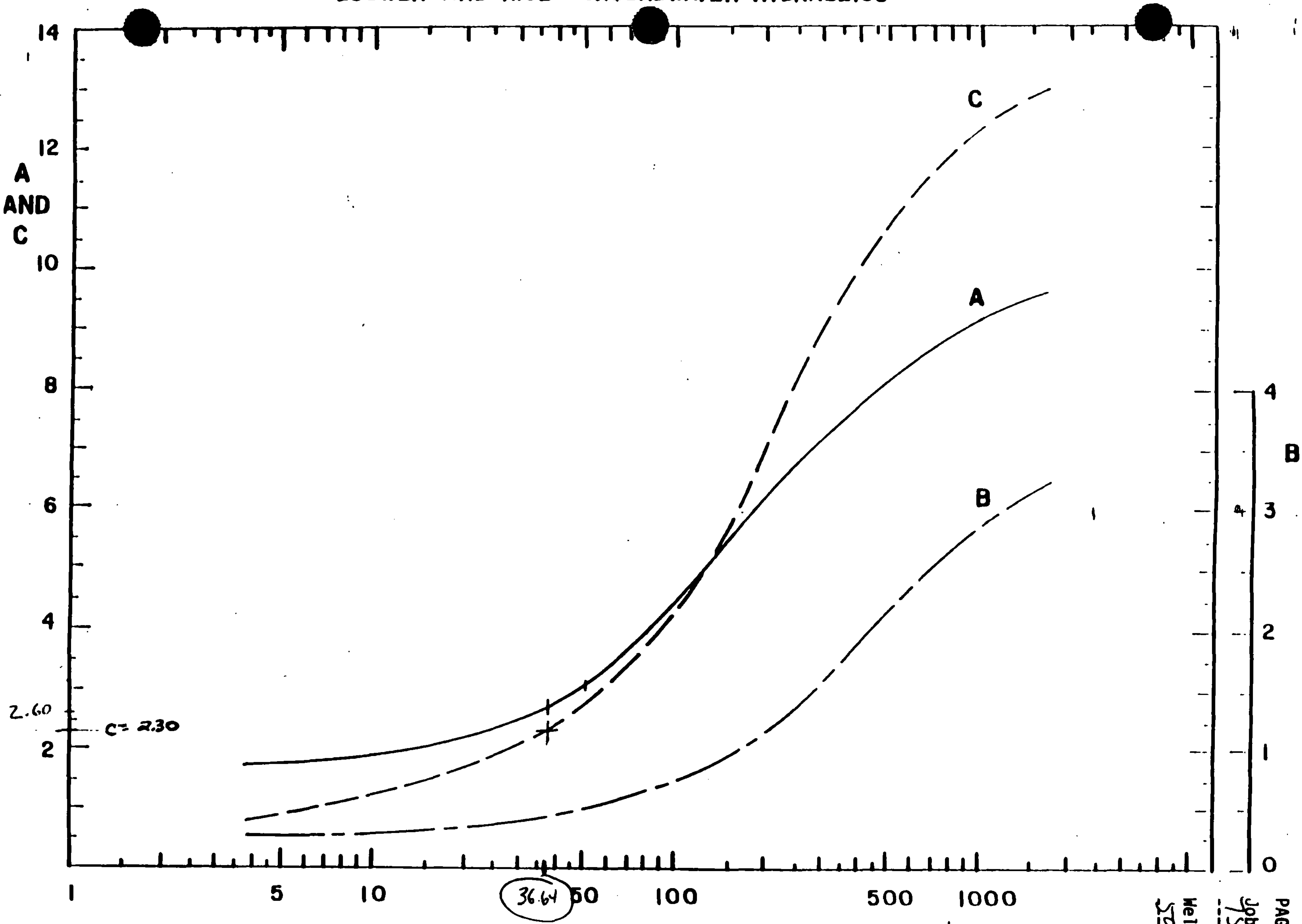


FIGURE I CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

PAGE 3
Job No. 75C3
Well No 5D3

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

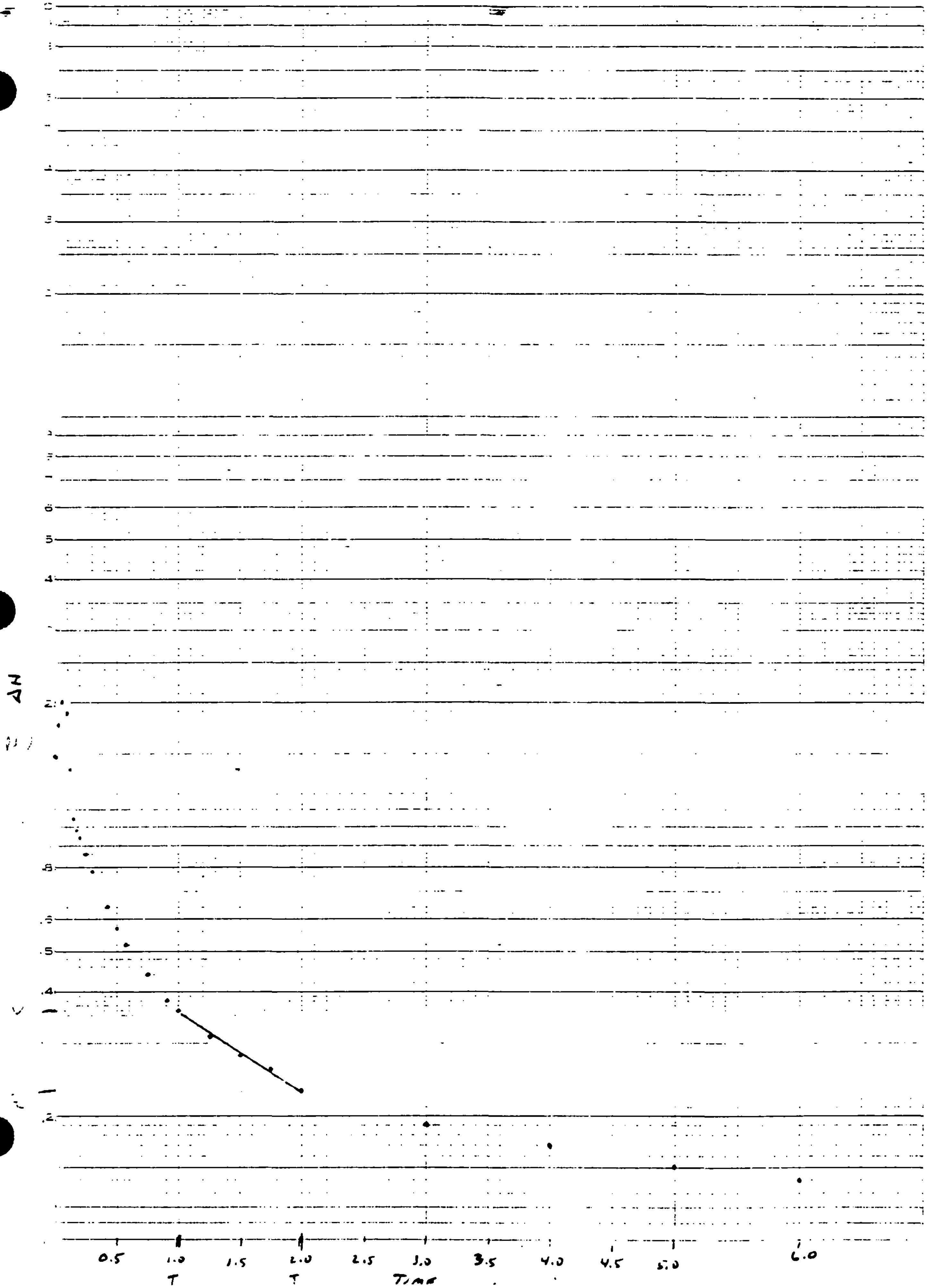
Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

t = 0 t (min.)	S.W.L. = 8.66 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
0.00	1.49	6.0	0.14		
0.30	1.77				
0.50	2.00				
0.10	1.88				
0.12	1.39				
0.15	1.05				
0.18	0.98				
0.20	0.94				
0.25	0.86				
0.30	0.78				
0.42	0.64				
0.50	0.57				
0.58	0.52				
0.75	0.44				
0.92	0.38				
1.00	0.36				
1.25	0.32				
1.50	0.28				
1.75	0.26				
2.0	0.23				
3.0	0.19				
4.0	0.17				
5.0	0.14				

MW 503



INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)
B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 2.30 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 9.34
D_d = ln[(D - H)/Rw] = ~~-.23~~ NA (must be ≤6)
H, Height of Well Below Water Table (ft) = 9.16
L, Height Through Which Water Enters Well (ft) = 9.16
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 60
Y_o, Starting Y (ft) = 0.36
Y_t, Ending Y (ft) = 0.23

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

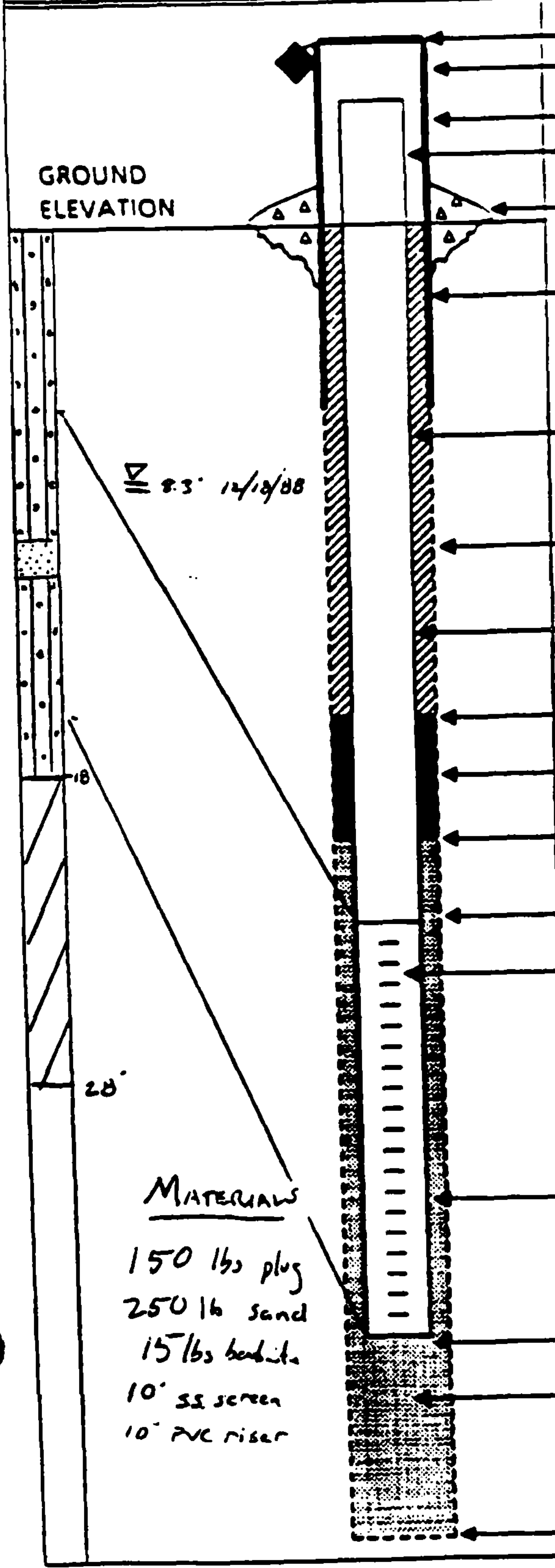
Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

BORING NO.: MW503

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: Sheppard AFB PROJECT NO.: 7863 ELEVATION: FIELD GEOLOGIST: R Polive	LOCATION: Wichita Falls TX BORING: MW 503 DATE: 12/10/88	DRILLER: W. Caldwell DRILLING METHOD: Air Rotary DEVELOPMENT METHOD: Air Lift



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING: FLUSH MOUNT

STICK-UP RISER PIPE: -0.18'

TYPE OF SURFACE SEAL: Concrete pad

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 4'

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 5'

ELEVATION / DEPTH TOP OF SCREEN: 6'

TYPE OF SCREEN: Stainless Steel

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 silica sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 16'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 18'

TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug - Bentonite

ELEVATION / DEPTH OF HOLE: 28

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW503
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	2.3
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	9.34
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	9.16
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	9.16
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	60
Yo. STARTING Y (ft) =	0.36
Yt. ENDING Y (ft) =	0.23

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.273764

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.715681

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALU FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.273764
FULLY PENETRATING. ln(Re/Rw) = 2.715681

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.715681

CALCULATION

K in ft/sec = 2.57E-05

K in cm/sec = 7.84E-04

Display 7

NUS CORPORATION

WELL NO.: MW503 ELEVATION: ______ DATE: 1/16/89
STATIC WATER LEVEL 8.56 + CORRECTION 0.1 = 8.66 TIME: 1438
ELEVATION WATER ______ REFERENCE INPUT 8.66 XD: 646

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	10.15	
	001	0.0033	10.17	
	002	0.0067	10.16	
	003	0.0100	10.08	
	004	0.0133	10.05	
	005	0.0167	10.23	
	006	0.0200	10.46	
	007	0.0233	10.53	
	008	0.0267	10.44	
✓	009	0.0300	10.43	
	010	0.0333	10.61	
✓	011	0.0500	10.66	
	012	0.0667	10.59	
	013	0.0833	10.64	
✓	014	0.1000	10.54	
✓	015	0.1167	10.05	
	016	0.1333	9.76	
✓	017	0.1500	9.71	
	018	0.1667	9.67	
✓	019	0.1833	9.64	
✓	020	0.2000	9.60	
	021	0.2167	9.57	
	022	0.2333	9.54	
✓	023	0.2500	9.52	
	024	0.2667	9.49	
	025	0.2833	9.46	
✓	026	0.3000	9.44	
	027	0.3167	9.42	
	028	0.3333	9.39	
✓	029	0.4167	9.30	
✓	030	0.5000	9.23	
✓	031	0.5833	9.18	
	032	0.6667	9.13	
✓	033	0.7500	9.10	
	034	0.8333	9.07	
✓	035	0.9167	9.04	
✓	036	1.0000	9.02	
	037	1.0833	9.01	
	038	1.1667	8.99	
✓	039	1.2500	8.98	
	040	1.3333	8.96	
	041	1.4167	8.95	
✓	042	1.5000	8.94	
	043	1.5833	8.94	
	044	1.6667	8.93	

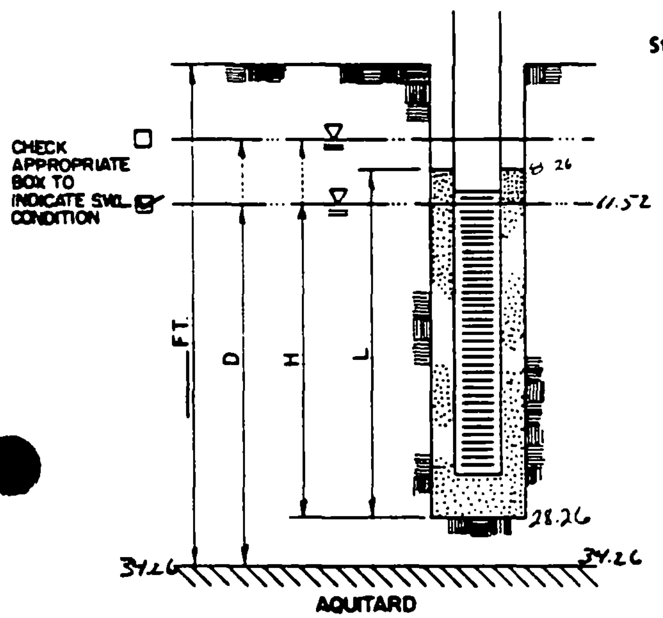
	Sample Number	Time (min)	
✓	045	1.7500	8.92
	046	1.8333	8.91
	047	1.9167	8.90
✓	048	2.0000	8.89
	049	2.5	8.87
✓	050	3.0	8.85
	051	3.5	8.84
✓	052	4.0	8.83
	053	4.5	8.82
✓	054	5.0	8.81
	055	5.5	8.80
✓	056	6.0	8.80
	057	6.5	8.80
	058	7.0	8.80
	059	7.5	8.80
	060	8.0	8.79
	061	8.5	8.79
	062	9.0	8.79
	063	9.5	8.79
	064	10.0	8.79
	065	12.0	8.78
	066	14.0	8.78
	067	16.0	8.77
	068	18.0	8.77
	069	20.0	8.77
	070	22.0	8.77
	071	24.0	8.77
	072	26.0	8.76
	073	28.0	8.76
	074	30.0	8.76
	075	32.0	
	076	34.0	
	077	36.0	
	078	38.0	
	079	40.0	
	080	42.0	
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB **TEST BY/DATE:** P. Pogue / J. Wedekind 1/16/89

JOB NUMBER: 7063 **CALCULATED BY/DATE:** J. Wedekind

WELL NUMBER: MW701 **CHECKED BY/DATE:** ______



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 11.52 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 8.26 ft. B.T.O.C.

Bott. Filter Pack = 28.26 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = ~~0.67~~ 0.33 ft.

Well Pipe Radius = ~~0.334~~ 0.17 ft.

Stickup = 2.26 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 16.74 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 16.74 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 22.74 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.33 (ft)

D_d = $\ln[(D - H)/R_w]$ = 2.90, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 6.70 \times 10^{-4} \text{ cm/sec}}$

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 50.72).

A = 3.1 B = 0.5 (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = —).

C = N/A (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.30 , T_t = 1.0 , Y_o = 0.36 , Y_t = 0.29

$$T = T_t - T_o = 42 \text{ (sec)}$$

Complete Page 5 in its entirety.

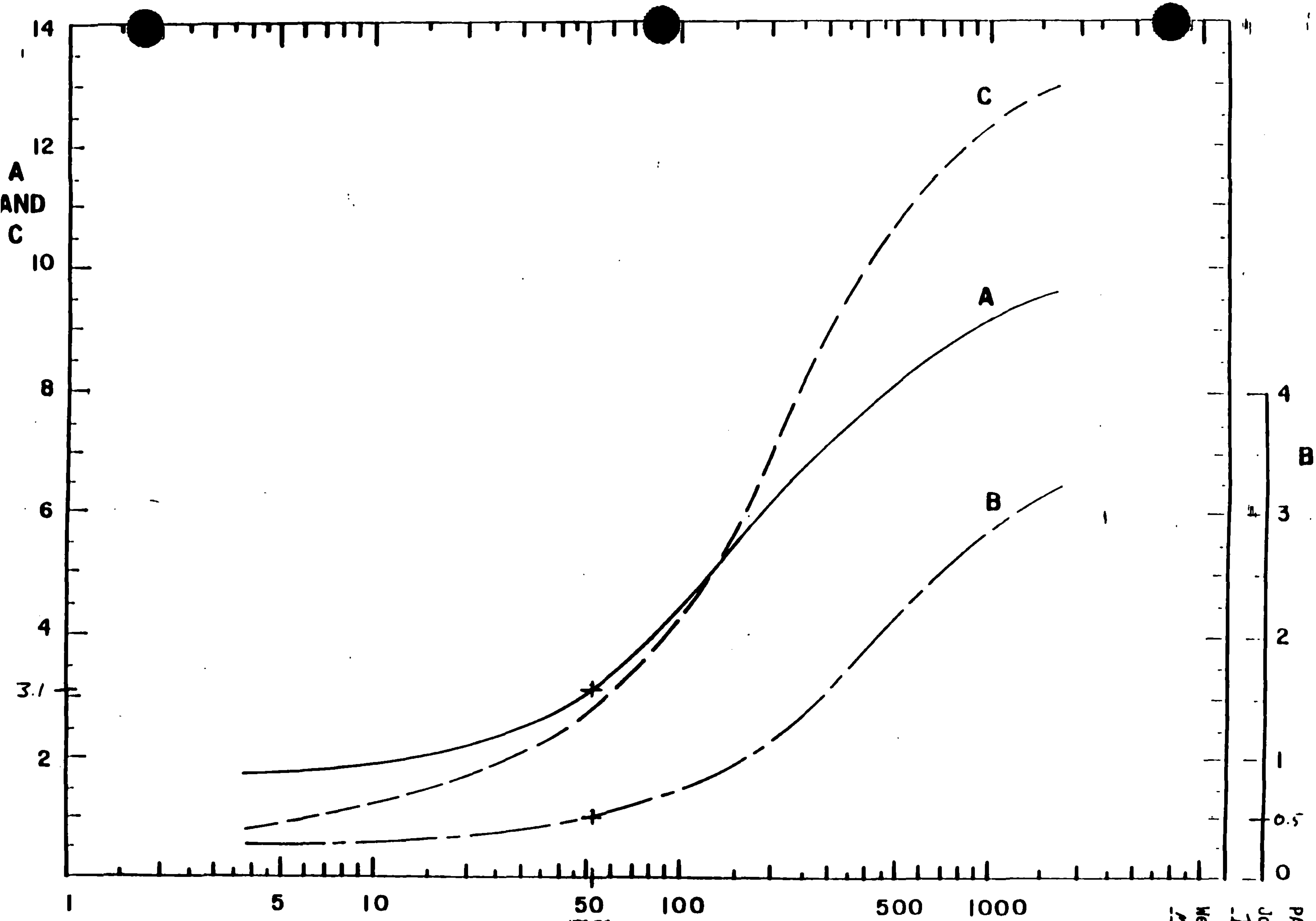


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

PAGE 3
Job No. 1563
Well No MW-201

Job No. 7563
Well No. AW701

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 11.52 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	0.43				
	0.03	0.43				
	0.05	0.42				
	0.10	0.41				
	0.15	0.39				
	0.20	0.38				
	0.25	0.37				
X_o	0.30	0.36				
	0.50	0.34				
	0.75	0.31				
X_t	1.0	0.29				
	1.5	0.27				
	2.0	0.24				
	3.0	0.21				
	4.0	0.17				
	5.0	0.16				
	6.0	0.14				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = ~~0.33~~ 0.17

Boring Radius (ft) = ~~0.67~~ 0.33

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 3.1 (N/A if not applicable)

B (from chart) = 0.5 (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = NA (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 22.74

D_d = ln[(D - H)/Rw] = 2.90 (must be ≤6)

H, Height of Well Below Water Table (ft) = 16.74

L, Height Through Which Water Enters Well (ft) = 16.74

Rw, Radius from Well Center to Aquifer (ft) = 0.33

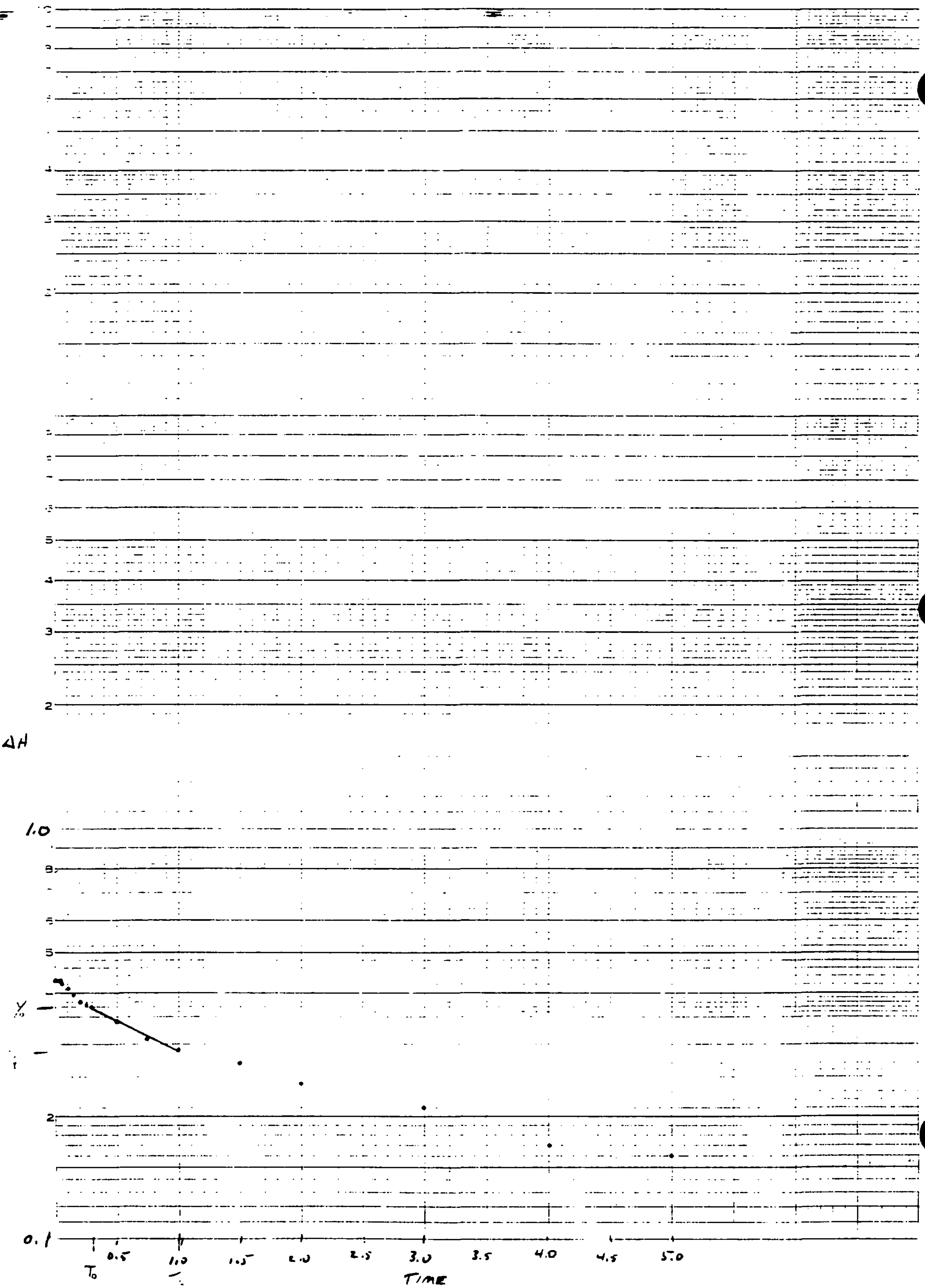
T, Time in seconds (T_t - T_o) = 42

Y_o, Starting Y (ft) = 0.36

Y_t, Ending Y (ft) = 0.29

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.



ΔH
1.0
0.1
Y_0
T_0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
TIME

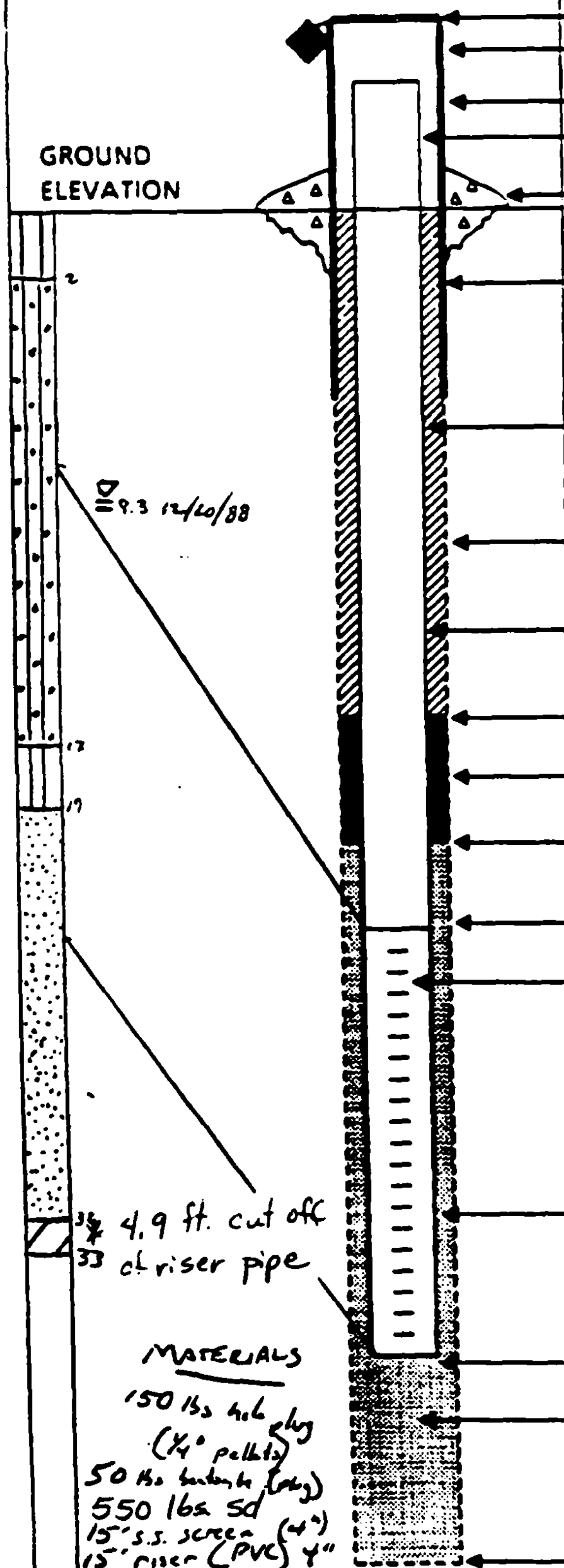
BORING NO.: SE 701

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: Sheppard AFB
LOCATION: Wichita Falls, Tx
PROJECT NO.: 7863
BORING: MW 701
ELEVATION:
DATE: 12-07-88
FIELD GEOLOGIST: P. Pogue, J. Wedekind

DRILLER: W. Caldwell
DRILLING METHOD: Air Rotary
DEVELOPMENT METHOD: Air Lift



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 2.49
STICK - UP RISER PIPE: 2.26
TYPE OF SURFACE SEAL: Concrete pad
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: Galvanized steel
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Volclay grout
ELEVATION / DEPTH TOP OF SEAL: 3.0
TYPE OF SEAL: Bentonite Pellets (¼")
DEPTH TOP OF SAND PACK: 6.0
ELEVATION / DEPTH TOP OF SCREEN: 8.0
TYPE OF SCREEN: Stainless steel
SLOT SIZE x LENGTH: 0.010" x 15'
I.D. OF SCREEN: 4"
TYPE OF SAND PACK: 20-40 silica sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 23.0
ELEVATION / DEPTH BOTTOM OF SAND PACK: 26.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug to 26.0
ELEVATION / DEPTH OF HOLE: 32.9

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW701
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.17
BORING RADIUS (ft) =	0.33
FILTER PACK POROSITY =	0.3
A (from chart) =	3.1
B (from chart) =	0.5
C (from chart) =	
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	22.74
Dd. = ln((D-H)/Rw) =	2.9
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	16.74
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	16.74
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.33
T. TIME IN SECONDS (Tt-To) =	42
Yo. STARTING Y (ft) =	0.36
Yt. ENDING Y (ft) =	0.29

CALCULATE Rc

Rc = 0.23

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.703830

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.569512

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 2.703830
FULLY PENETRATING. ln(Re/Rw) = 3.569512

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.70383

CALCULATION

K in ft/sec = 2.20E-05

K in cm/sec = 6.70E-04

Display 9

NUS CORPORATION

WELL No.: MW 701 ELEVATION: ______ DATE: 1/16/89

STATIC WATER LEVEL 11.42 + CORRECTION 0.1 = 11.52 TIME: 1650

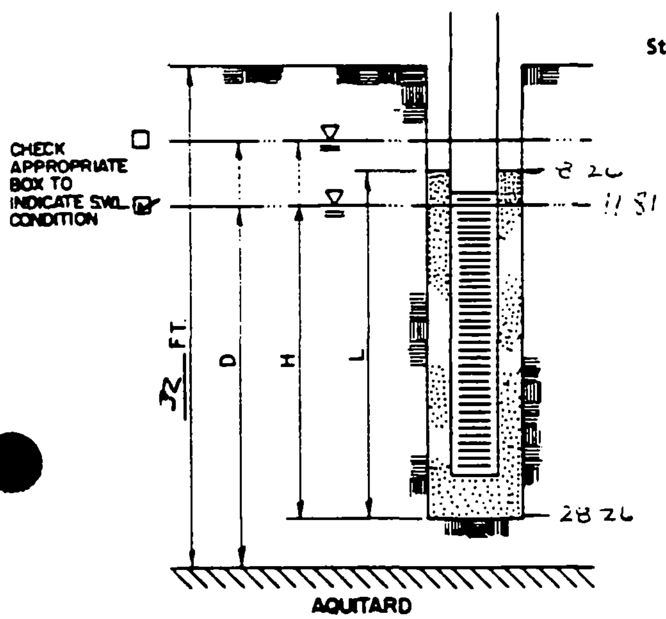
ELEVATION WATER ______ REFERENCE INPUT 11.52 XD: 13.19

	Sample Number	Time (min)	SLUG IN/OUT	ΔH	SLUG IN/OUT
	000	0.0000	11.94		
✓	001	0.0033	11.95	0.43	
	002	0.0067	11.95		
	003	0.0100	11.95		
	004	0.0133	11.95		
	005	0.0167	11.95		
	006	0.0200	11.95		
	007	0.0233	11.95		
	008	0.0267	11.95		
✓	009	0.0300	11.95	0.43	
	010	0.0333	11.95		
✓	011	0.0500	11.94	0.42	
	012	0.0667	11.94		
	013	0.0833	11.93		
✓	014	0.1000	11.93	0.41	
	015	0.1167	11.92		
	016	0.1333	11.92		
✓	017	0.1500	11.91	0.39	
	018	0.1667	11.91		
	019	0.1833	11.91		
✓	020	0.2000	11.90	0.38	
	021	0.2167	11.90		
	022	0.2333	11.90		
✓	023	0.2500	11.89	0.37	
	024	0.2667	11.89		
	025	0.2833	11.89		
✓	026	0.3000	11.88	0.36	
	027	0.3167	11.88		
	028	0.3333	11.88		
	029	0.4167	11.87		
✓	030	0.5000	11.86	0.34	
	031	0.5833	11.85		
	032	0.6667	11.84		
✓	033	0.7500	11.83	0.31	
	034	0.8333	11.82		
	035	0.9167	11.82		
✓	036	1.0000	11.81	0.29	
	037	1.0833	11.81		
	038	1.1667	11.80		
	039	1.2500	11.80		
	040	1.3333	11.79		
	041	1.4167	11.79		
✓	042	1.5000	11.79	0.27	
	043	1.5833	11.78		
	044	1.6667	11.78		

	Sample Number	Time (min)		ΔH
	045	1.7500	11.77	
	046	1.8333	11.77	
	047	1.9167	11.76	
✓	048	2.0000	11.76	0.24
	049	2.5	11.74	
✓	050	3.0	11.73	0.21
	051	3.5	11.71	
✓	052	4.0	11.69	0.17
	053	4.5	11.68	
✓	054	5.0	11.68	0.16
	055	5.5	11.67	
✓	056	6.0	11.66	0.14
	057	6.5	11.65	
	058	7.0	11.65	0.13
	059	7.5	11.64	
	060	8.0	11.64	
	061	8.5	11.63	
	062	9.0	11.62	
	063	9.5	11.62	
	064	10.0	11.61	
	065	12.0	11.60	
	066	14.0	11.57	
	067	16.0	11.56	
	068	18.0	11.55	
	069	20.0	11.55	
	070	22.0	11.54	
	071	24.0	11.54	
	072	26.0	11.53	
	073	28.0	11.53	
	074	30.0	11.53	
	075	32.0	11.53	
	076	34.0	11.53	
	077	36.0		
	078	38.0		
	079	40.0		
	080	42.0		
	081	44.0		
	082	46.0		
	083	48.0		
	084	50.0		
	085	52.0		
	086	54.0		
	087	56.0		
	088	58.0		
	089	60.0		

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	**TEST BY/DATE:**	P Pogue 1/13/89
JOB NUMBER:	7$63	**CALCULATED BY/DATE:**	J. ... 2/7/89
WELL NUMBER:	MW 701	**CHECKED BY/DATE:**	J. Conti 9/5/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 11.81 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 8.26 ft. B.T.O.C.

Bott. Filter Pack = 28.26 ft. B.T.O.C.

Screen Length = 15' ft.

Borehole Radius = ~~0.67~~ 0.33' ft.

Well Pipe Radius = ~~0.33~~ 0.17' ft.

Stickup = 2.26 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

- L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 16.45 (ft)*
- H = HEIGHT OF WELL BELOW WATER TABLE = 16.45 (ft)
- D = DEPTH TO IMPERMEABLE BOUNDARY = ~~32.26~~ 22.45 (ft)**
- R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.33 (ft)
- D_d = $\ln[(D - H)/R_w]$ = 2.90, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{K = 5.33 \times 10^{-4} \text{ cm/sec}}$

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 49.85).

A = 3.00 B = 0.53 (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = ____).

C = NA (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.5, T_t = 2.0, Y_o = 0.36, Y_t = 0.25

$$T = T_t - T_o = 90 \text{ (sec)}$$

Complete Page 5 in its entirety.

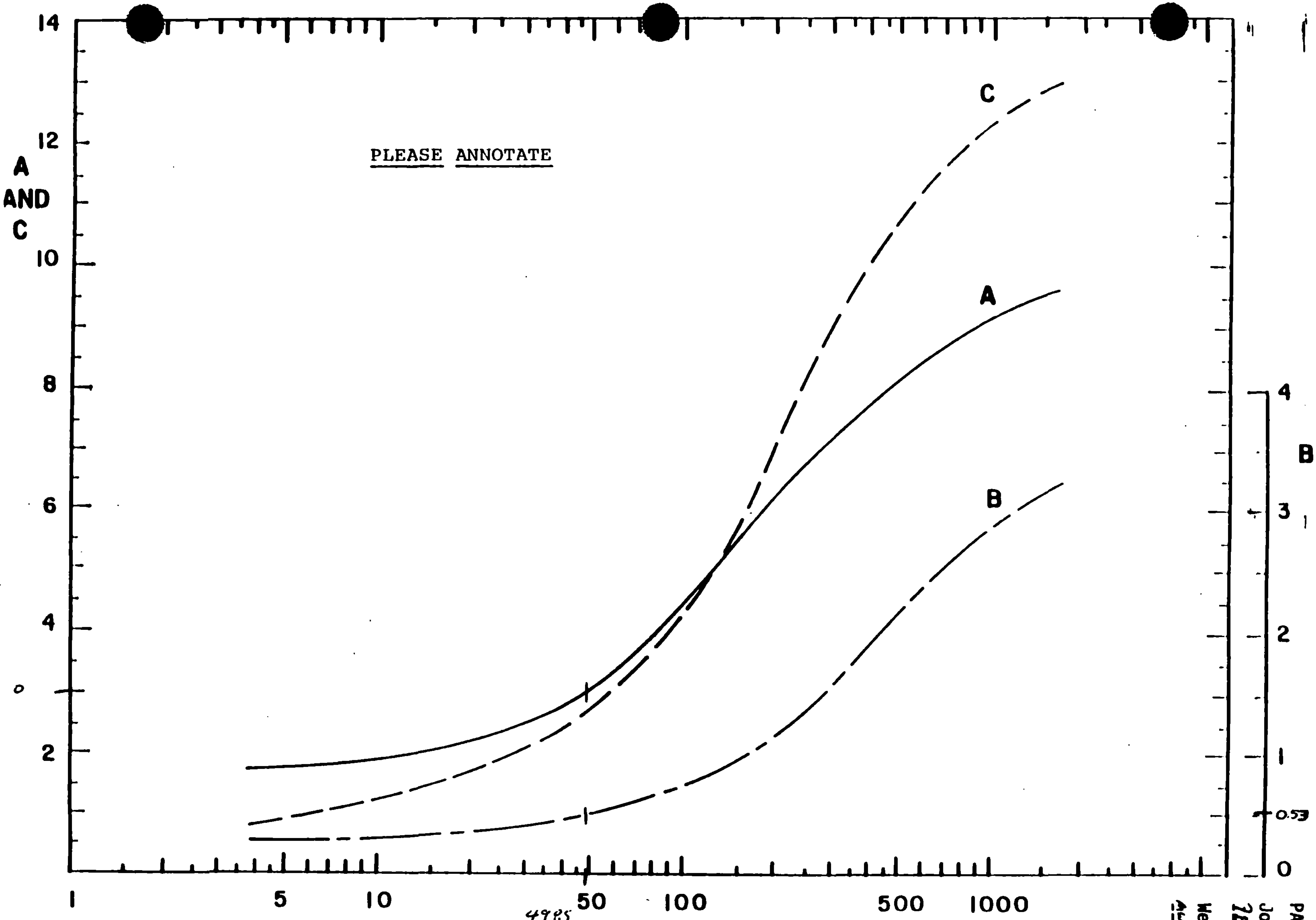


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

PAGE 3
Job No. 7863
Well No AW701

Job No. 7163
Well No. MW701

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 11.81 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	1.27				
	0.03	2.46				
	0.05	2.34				
	0.10	0.50				
	0.15	0.48				
	0.20	0.44				
	0.25	0.43				
	0.30	0.41				
	0.42	0.38				
X_0	0.50	0.36				
	0.75	0.33				
	1.00	0.31				
	1.25	0.29				
	1.50	0.28				
	1.75	0.26				
X_t	2.00	0.25				
	2.50	0.23				
	3.0	0.21				
	4.0	0.18				
	5.0	0.16				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.17'
Boring Radius (ft) = 0.33'
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 3.00 (N/A if not applicable)
B (from chart) = 0.53 (N/A if not applicable)

FULLY PENETRATING WELL:

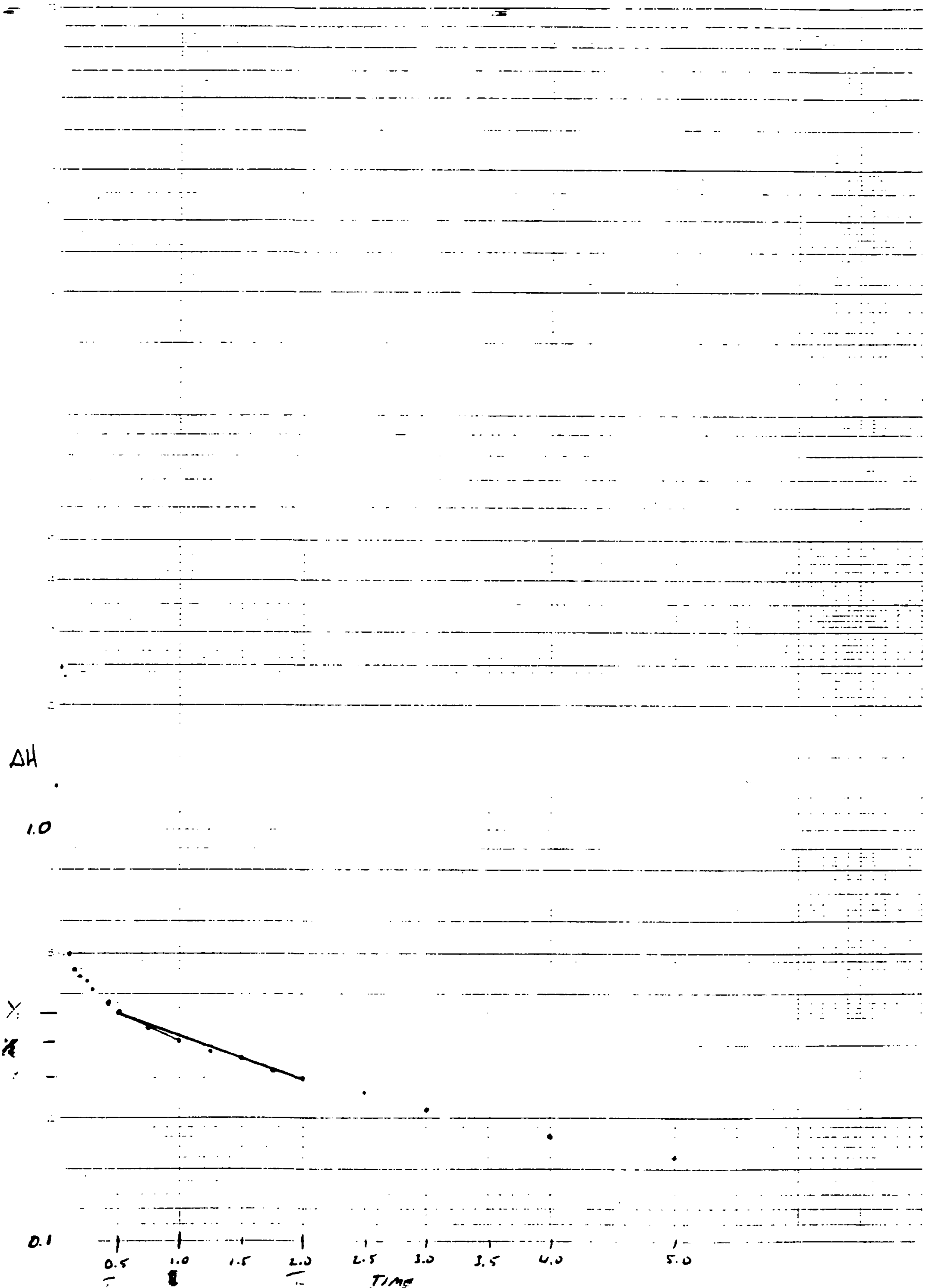
C (from chart) = NA (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 22.45
D_d = ln[(D - H)/Rw] = 2.90 (must be ≤6)
H, Height of Well Below Water Table (ft) = 16.45
L, Height Through Which Water Enters Well (ft) = 16.45
Rw, Radius from Well Center to Aquifer (ft) = 0.33
T, Time in seconds (T_t - T_o) = 90
Y_o, Starting Y (ft) = 0.36
Y_t, Ending Y (ft) = 0.25

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Transducer disturbed - note irregularities of first part of curve.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.

MW701



SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW701
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.17
BORING RADIUS (ft) =	0.33
FILTER PACK POROSITY =	0.3
A (from chart) =	3
B (from chart) =	0.53
C (from chart) =	
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	22.45
Dd. = ln((D-H)/Rw) =	2.9
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	16.45
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	16.45
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.33
T. TIME IN SECONDS (Tt-To) =	90
Yo. STARTING Y (ft) =	0.36
Yt. ENDING Y (ft) =	0.25

CALCULATE Rc

Rc = 0.23

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.685150

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.553625

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 2.685150
FULLY PENETRATING. ln(Re/Rw) = 3.553625

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.68515

CALCULATION

K in ft/sec = 1.75E-05

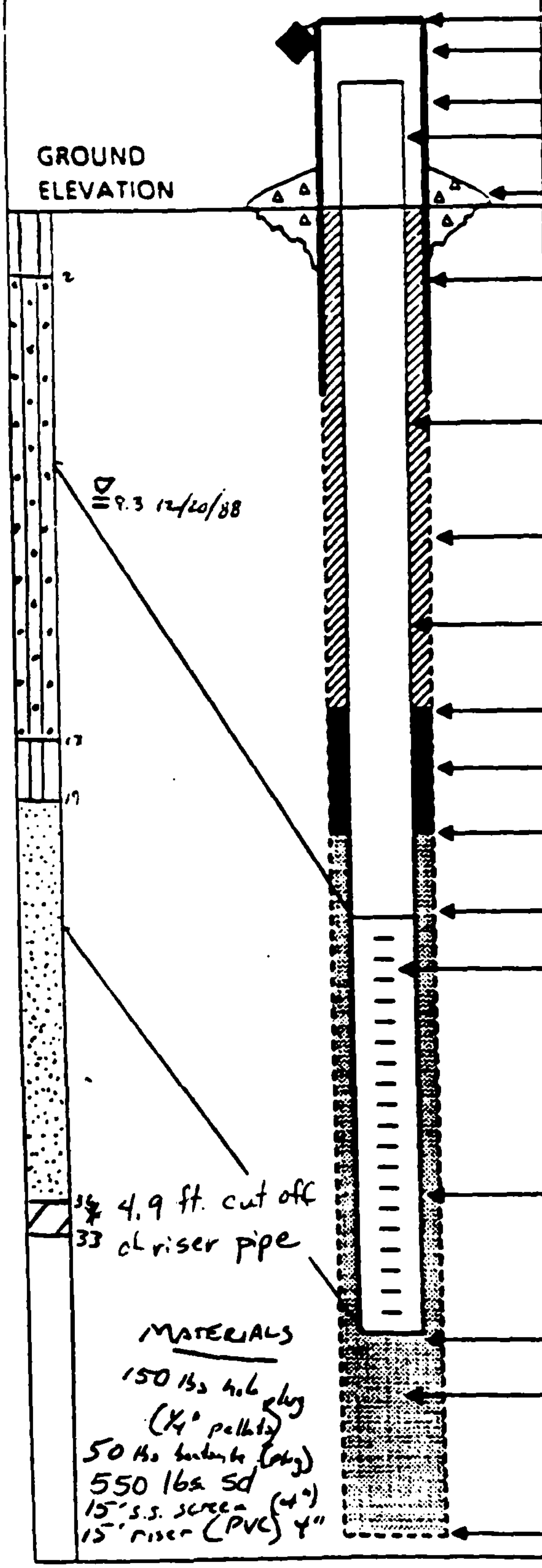
K in cm/sec = 5.33E-04

BORING NO.: SE 701

NUS CORPORATION

OVERBURDEN MONITORING WELL SHEET

PROJECT: Sheppard AFB	LOCATION: Wichita Falls, Tx	DRILLER: W. Caldwell
PROJECT NO.: 7863	BORING: MW 701	DRILLING METHOD: Air Rotary
ELEVATION:	DATE: 12-07-88	DEVELOPMENT METHOD: Air Lift
FIELD GEOLOGIST: P. Pogue, J. Wedekind		



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: 2.49

STICK - UP RISER PIPE: 2.26

TYPE OF SURFACE SEAL: Concrete pad

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: Galvanized steel

RISER PIPE I.D. 4"

TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: Volclay grout

ELEVATION / DEPTH TOP OF SEAL: 3.0

TYPE OF SEAL: Bentonite Pellets (1/4")

DEPTH TOP OF SAND PACK: 6.0

ELEVATION / DEPTH TOP OF SCREEN: 8.0

TYPE OF SCREEN: Stainless steel

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 4"

TYPE OF SAND PACK: 20-40 silica sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 23.0

ELEVATION / DEPTH BOTTOM OF SAND PACK: 26.0

TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug to 26.0

ELEVATION / DEPTH OF HOLE: 32.9

Display 6

NUS CORPORATION

WELL NO.: MW-701 ELEVATION: ______ DATE: 1/13/89

STATIC WATER LEVEL 11.61 + CORRECTION 0.2 = 11.81 TIME: 162

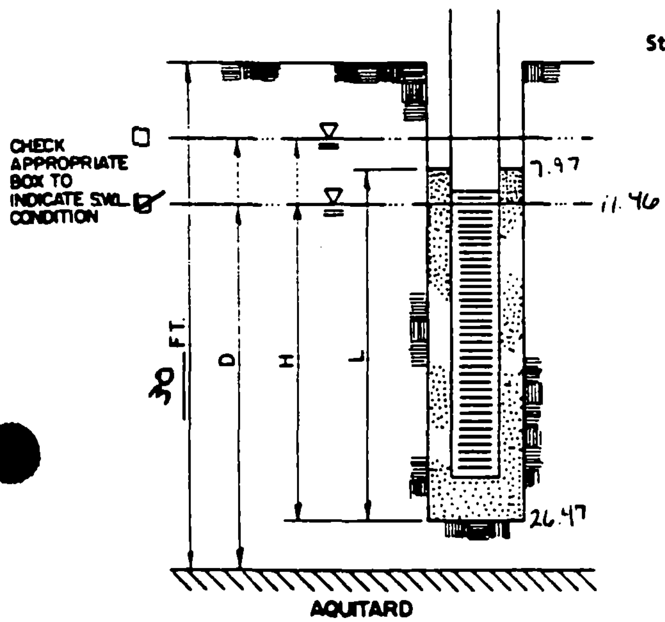
ELEVATION WATER ______ REFERENCE INPUT 11.81 XD: 13.12

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	13.08	
✓	001	0.0033	13.18	
	002	0.0067	13.52	
	003	0.0100	13.45	
	004	0.0133	13.58	
	005	0.0167	13.75	
	006	0.0200	13.94	
	007	0.0233	14.11	
	008	0.0267	14.25	
✓	009	0.0300	14.27	
	010	0.0333	14.21	
✓	011	0.0500	14.15	
	012	0.0667	13.87	
	013	0.0833	13.30 TRANSDUCER DISTURBED	
✓	014	0.1000	12.31	
	015	0.1167	12.28	
	016	0.1333	12.28	
✓	017	0.1500	12.27	
	018	0.1667	12.26	
	019	0.1833	12.26	
✓	020	0.2000	12.25	
	021	0.2167	12.24	
	022	0.2333	12.24	
✓	023	0.2500	12.24	
	024	0.2667	12.23	
	025	0.2833	12.22	
✓	026	0.3000	12.22	
	027	0.3167	12.21	
	028	0.3333	12.21	
✓	029	0.4167	12.19	
✓	030	0.5000	12.17	
	031	0.5833	12.16	
	032	0.6667	12.15	
✓	033	0.7500	12.14	
	034	0.8333	12.13	
	035	0.9167	12.12	
✓	036	1.0000	12.12	
	037	1.0833	12.11	
	038	1.1667	12.10	
✓	039	1.2500	12.10	
	040	1.3333	12.09	
	041	1.4167	12.09	
✓	042	1.5000	12.09	
	043	1.5833	12.08	
	044	1.6667	12.08	

	Sample Number	Time (min)	
✓	045	1.7500	12.07
	046	1.8333	12.07
	047	1.9167	12.06
✓	048	2.0000	12.06
✓	049	2.5	12.04
✓	050	3.0	12.02
	051	3.5	12.00
✓	052	4.0	11.99
	053	4.5	11.98
✓	054	5.0	11.97
			T90
	055	5.5	11.96
	056	6.0	11.95
	057	6.5	11.94
	058	7.0	11.94
	059	7.5	11.93
	060	8.0	11.92
	061	8.5	11.92
	062	9.0	11.91
	063	9.5	11.91
	064	10.0	11.91
	065	12.0	11.89
	066	14.0	11.88
	067	16.0	11.87
	068	18.0	11.86
	069	20.0	11.85
	070	22.0	
	071	24.0	
	072	26.0	
	073	28.0	
	074	30.0	
	075	32.0	
	076	34.0	
	077	36.0	
	078	38.0	
	079	40.0	
	080	42.0	
	081	44.0	
	082	46.0	
	083	48.0	
	084	50.0	
	085	52.0	
	086	54.0	
	087	56.0	
	088	58.0	
	089	60.0	

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
TEST BY/DATE: P. Pogue 1/13/89
JOB NUMBER: 7563
CALCULATED BY/DATE: J. Wedeland 2/7/89
WELL NUMBER: MW 702
CHECKED BY/DATE: JAC 9/8/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 11.46 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 7.97 ft. B.T.O.C.

Bott. Filter Pack = 26.47 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.47 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 15.01 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 15.01 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 21.01 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = 3.18, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{1.20 \times 10^{-3} \text{ cm/sec}}$

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 60.04).

A = 3.47 B = 0.65 (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 60.04).

C = NA (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.42, T_t = 0.83, Y_o = 0.96, Y_t = 0.61

$$T = T_t - T_o = 24.6 \text{ (sec)}$$

Complete Page 5 in its entirety.

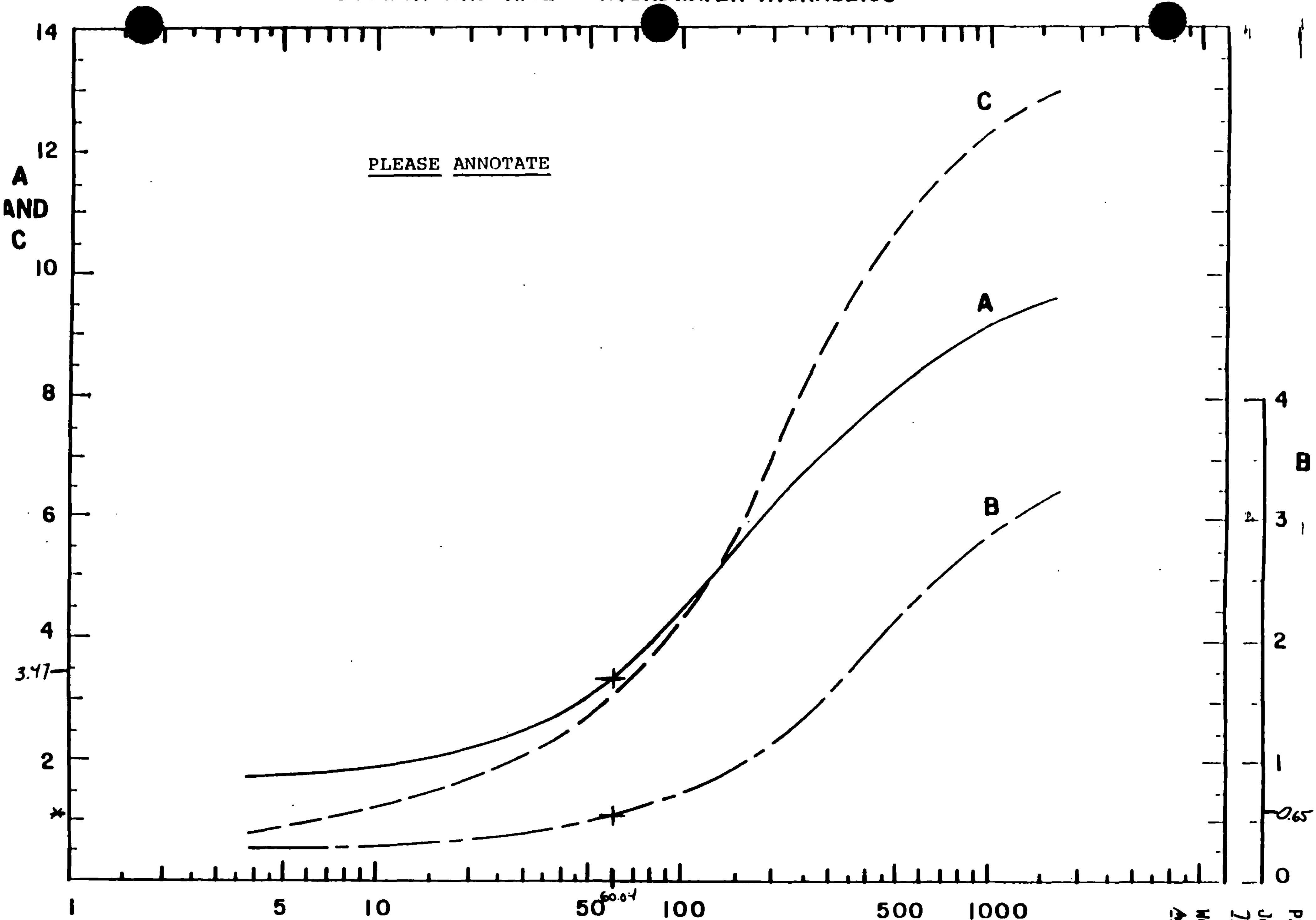


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

PAGE 3
Job No. 7843
Well No MW-202

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 11.46 y (feet)
	0.00	1.74
	0.02	1.60
	0.03	1.68
	0.033	1.70
	0.05	1.62
	0.08	1.58
	0.10	1.51
	0.13	1.43
	0.15	1.40
	0.167	1.36
	0.20	1.30
	0.25	1.21
	0.30	1.13
	0.33	1.08
X_0 –	0.42	0.96
	0.50	0.86
	0.58	0.78
	0.67	0.71
	0.75	0.66
X_t –	0.83	0.61
	0.91	0.58
	1.00	0.55
	1.25	0.48

t (min.)	y (feet)
1.50	0.43
1.75	0.40
2.00	0.37
2.50	0.32
3.0	0.29

t (min.)	y (feet)

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 3.47 (N/A if not applicable)

B (from chart) = 0.65 (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = NA (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 21.01

D_d = ln[(D - H)/Rw] = 3.18 (must be ≤6)

H, Height of Well Below Water Table (ft) = 15.01

L, Height Through Which Water Enters Well (ft) = 15.01

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds (T_t - T_o) = 24.6

Y_o, Starting Y (ft) = 0.96

Y_t, Ending Y (ft) = 0.61

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. <u>DO NOT</u> save your calculation file as /SLUGCALC. <u>DO NOT</u> save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24., 1989
JOB NO: 7S63
WELL NO: MW702
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value, leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	3.47
B (from chart) =	0.65
C (from chart) =	
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	21.01
Dd. = ln((D-H)/Rw) =	3.18
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	15.01
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	15.01
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	24.6
Yo. STARTING Y (ft) =	0.96
Yt. ENDING Y (ft) =	0.61

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.771300

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.722737

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 2.771300
FULLY PENETRATING. ln(Re/Rw) = 3.722737

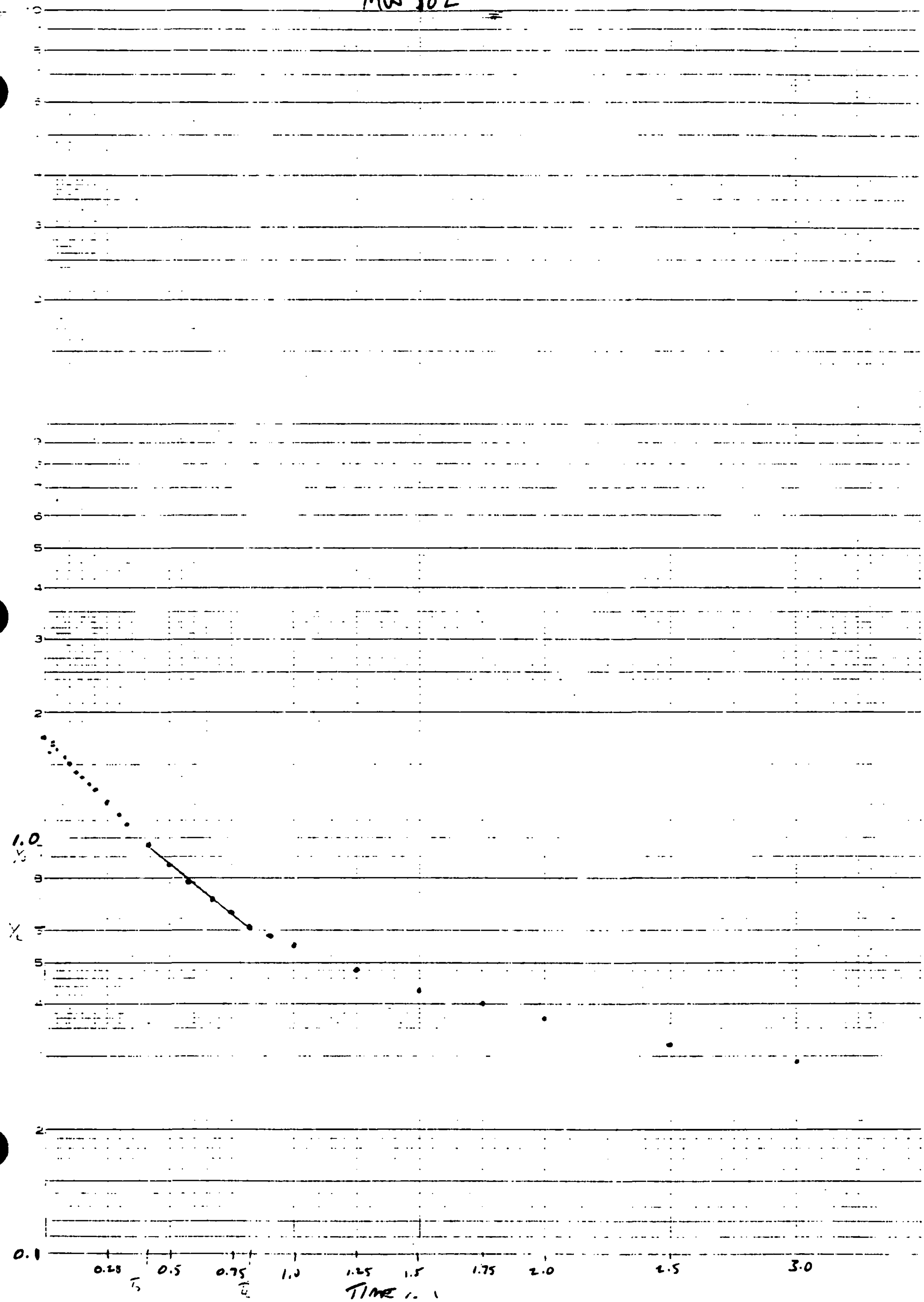
THE CORRECT VALUE OF ln(Re/Rw) IS: 2.7713

CALCULATION

K in ft/sec = 3.95E-05

K in cm/sec = 1.20E-03

Mw 702



NUS CORPORATION

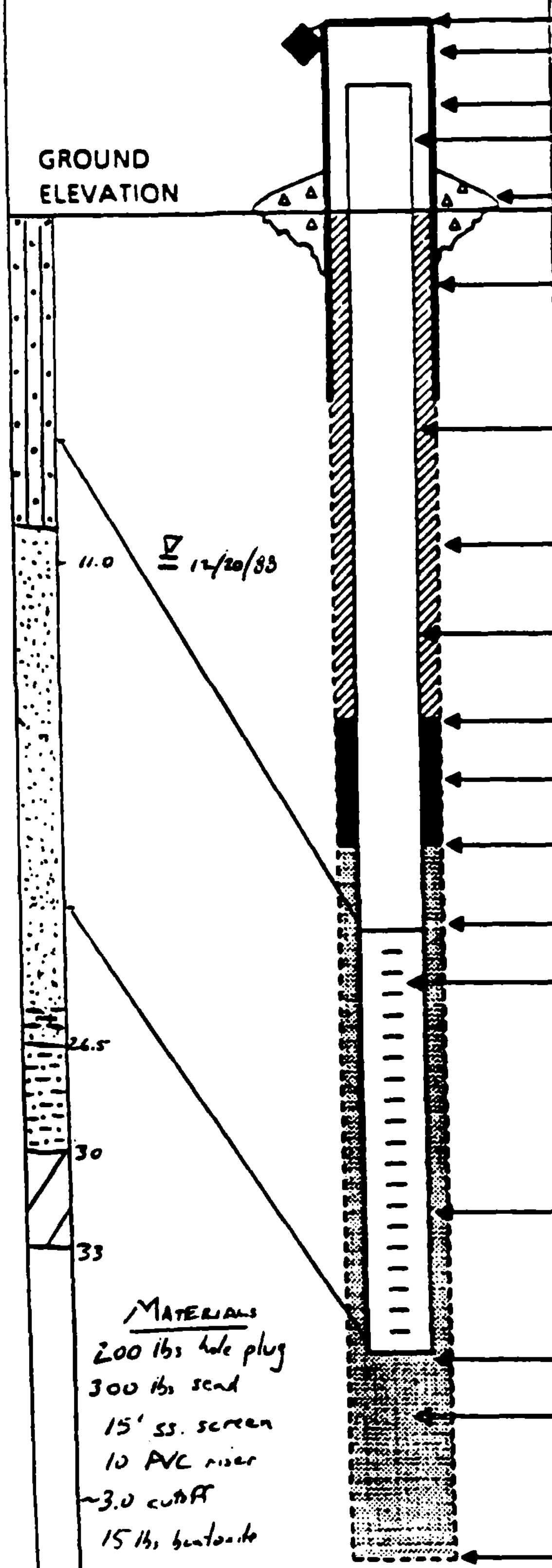
BORING NO.: MW 702

OVERBURDEN
MONITORING WELL SHEET

PROJECT Sheppard AFB
PROJECT NO. 7$63
ELEVATION
FIELD GEOLOGIST J. Wedekind

LOCATION Wichita Falls, TX
BORING MW 702
DATE 12/10/88

DRILLER W. Caldwell
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift / Bailing



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: 3.15

STICK - UP RISER PIPE: 2.47

TYPE OF SURFACE SEAL: Concrete Pad

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: Steel x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 4.0

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 5.5

ELEVATION / DEPTH TOP OF SCREEN: 7.0

TYPE OF SCREEN: Stainless Steel

SLOT SIZE x LENGTH: 0.010 x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20 - 40 Silica Sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 22.0

ELEVATION / DEPTH BOTTOM OF SAND PACK: 24.0

TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole Plug (Bentonite wafers)

ELEVATION / DEPTH OF HOLE: 33.0

Materials
200 lbs hole plug
300 lbs sand
15' ss. screen
10 PVC riser
~3.0 cutoff
15 lbs bentonite

Display 7

NUS CORPORATION

WELL NO.: MW702 ELEVATION: ______ DATE: 1/13/89

STATIC WATER LEVEL 11.26 + CORRECTION 0.2 = 11.46 TIME 1701

ELEVATION WATER ______ REFERENCE INPUT 11.46 XD: 5.23

Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
000	0.0000	13.20	
001	0.0033	13.21	
002	0.0067	13.19	
003	0.0100	13.19	
004	0.0133	13.18	
005	0.0167	13.17	
006	0.0200	13.16	
007	0.0233	13.16	
008	0.0267	13.15	
009	0.0300	13.14	
010	0.0333	13.16	
011	0.0500	13.08	
012	0.0667	13.04	
013	0.0833	13.00	
014	0.1000	~~12.97~~ PSP 12.97	
015	0.1167	12.93	
016	0.1333	12.89	
017	0.1500	12.86	
018	0.1667	12.82	
019	0.1833	12.79	
020	0.2000	12.76	
021	0.2167	12.73	
022	0.2333	12.70	
023	0.2500	12.67	
024	0.2667	12.64	
025	0.2833	~~12.67~~ PSP 12.61	
026	0.3000	12.59	
027	0.3167	12.56	
028	0.3333	12.54	
029	0.4167	12.42	
030	0.5000	12.32	
031	0.5833	12.24	
032	0.6667	12.17	
033	0.7500	12.12	
034	0.8333	12.07	
035	0.9167	12.04	
036	1.0000	12.01	
037	1.0833	11.98	
038	1.1667	11.96	
039	1.2500	11.94	
040	1.3333	11.93	
041	1.4167	11.91	
042	1.5000	11.89	
043	1.5833	11.88	
044	1.6667	11.87	

Sample Number	Time (min)	
045	1.7500	11.86
046	1.8333	11.85
047	1.9167	11.84
048	2.0000	11.83
049	2.5	11.78
050	3.0	11.75
051	3.5	11.72
052	4.0	11.69
053	4.5	11.67
054	5.0	11.66
055	5.5	11.64
056	6.0	11.63
057	6.5	11.62
058	7.0	11.61
059	7.5	11.60
060	8.0	11.59
061	8.5	11.58
062	9.0	11.57
063	9.5	11.57
064	10.0	11.56
065	12.0	11.54
066	14.0	11.52
067	16.0	11.51
068	18.0	11.51
069	20.0	11.50
070	22.0	11.49
071	24.0	
072	26.0	
073	28.0	
074	30.0	
075	32.0	
076	34.0	
077	36.0	
078	38.0	
079	40.0	
080	42.0	
081	44.0	
082	46.0	
083	48.0	
084	50.0	
085	52.0	
086	54.0	
087	56.0	
088	58.0	
089	60.0	

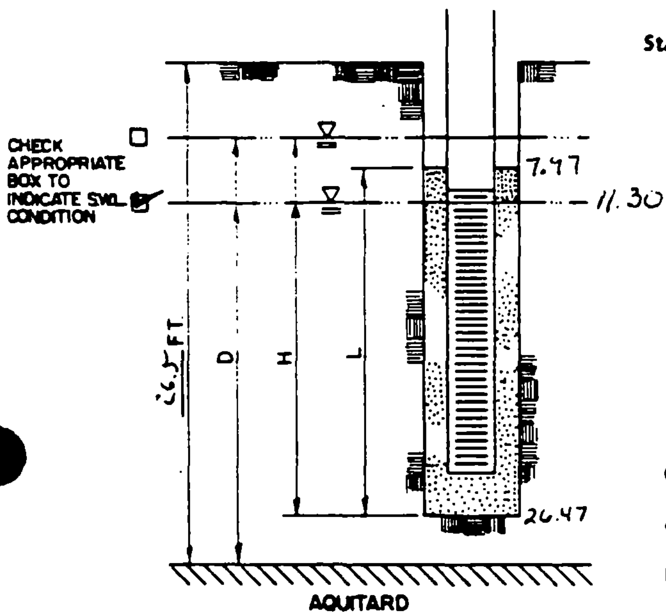
INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: SHEPPARD AFB
TEST BY/DATE: P. Payne : 1/16/89

JOB NUMBER: 7563
CALCULATED BY/DATE: J. Wedekind : 2/7/89

WELL NUMBER: MW702
CHECKED BY/DATE: 7/8/89

CHECK APPROPRIATE BOX TO INDICATE SWL CONDITION



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 11.30 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 7.97 ft. B.T.O.C.

Bott. Filter Pack = 26.47 ft. B.T.O.C.

Screen Length = 15 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.47 ft above/~~below~~ grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 15.17 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 15.17 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = ~~98.70~~ 17.67 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = ~~2.6509~~ 2.30, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

2.01 × 10^{-4} cm/sec

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 60.68).

A = 3.45 B = 0.55 (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = ____).

C = ________ (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.5, T_t = 1.0, Y_o = 1.03, Y_t = 0.67

$$T = T_t - T_o = 30 \text{ (sec)}$$

Complete Page 5 in its entirety.

BOUWER AND RICE : GROUNDWATER HYDRAULICS

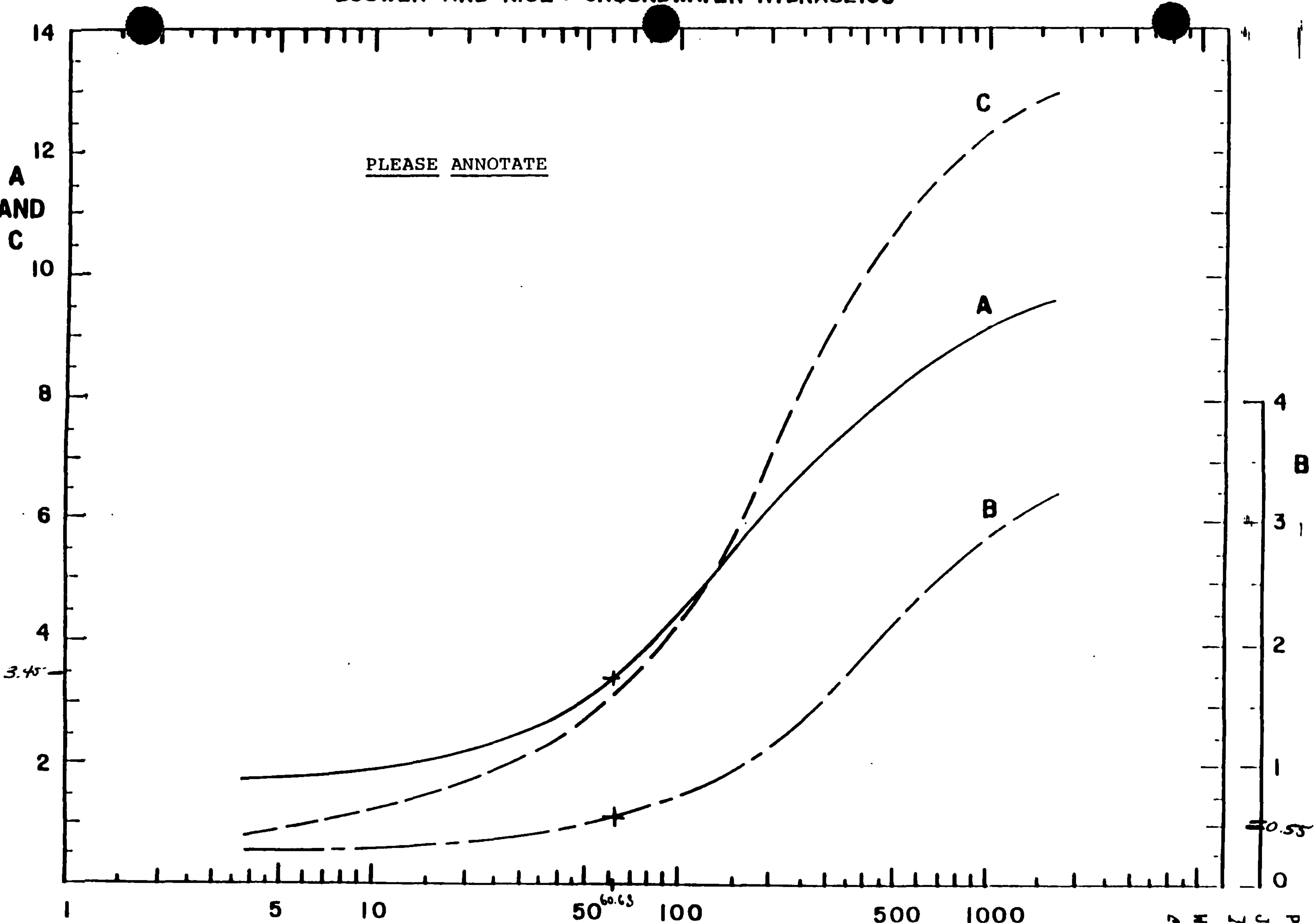


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

Job No. 7Ø63
Well No. MW702

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 ______ t (min.)	S.W.L. = ______ y (feet)
	0.00	1.97
	0.02	1.92
	0.03	1.89
	0.03	1.88
	0.05	1.84
	0.08	1.75
	0.10	1.71
	0.13	1.64
	0.15	1.60
	0.167	1.57
	0.20	1.50
	0.25	1.41
	0.30	1.32
	0.33	1.26
	0.42	1.14
x_o —	0.50	1.03
	0.58	0.94
	0.67	0.87
	0.75	0.80
	0.83	0.75
	0.91	0.71
x_t —	1.00	0.67
	1.25	0.60

t (min.)	y (feet)
1.50	0.54
1.75	0.49
2.00	0.46
2.50	0.40
3.0	0.36

t (min.)	y (feet)

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08
Boring Radius (ft) = 0.25
Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = 3.45 (N/A if not applicable)
B (from chart) = 0.55 (N/A if not applicable)

FULLY PENETRATING WELL:

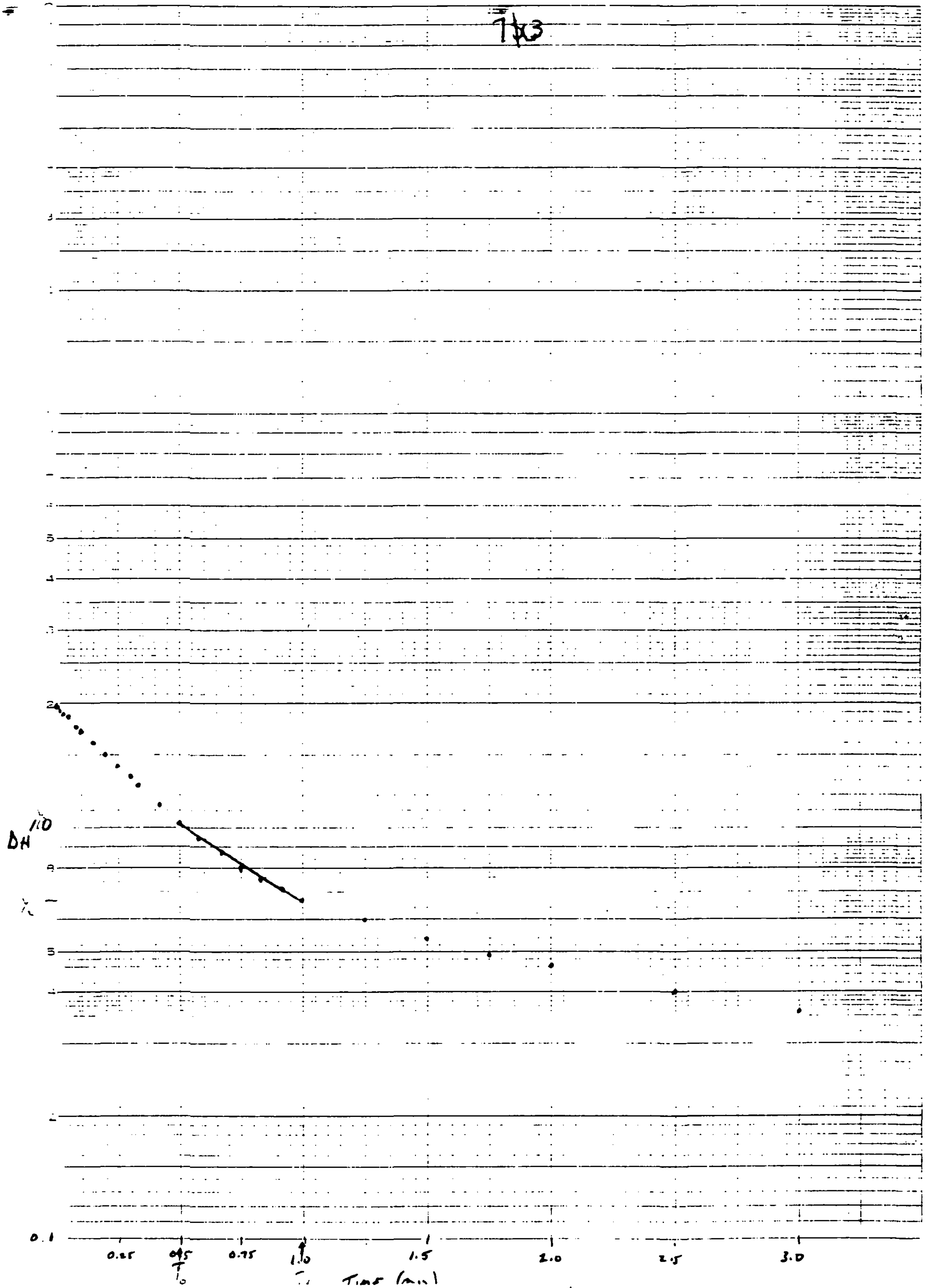
C (from chart) = NA (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = ~~18.70~~ 17.67
D_d = ln[(D - H)/Rw] = ~~2.65~~ 2.30 (must be ≤6)
H, Height of Well Below Water Table (ft) = 15.17
L, Height Through Which Water Enters Well (ft) = 15.17
Rw, Radius from Well Center to Aquifer (ft) = 0.25
T, Time in seconds (T_t - T_o) = 30
Y_o, Starting Y (ft) = 1.03
Y_t, Ending Y (ft) = 0.67

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY):

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

MW702



Display 8

NUS CORPORATION

WELL No.: MW702 ELEVATION: ______ DATE: 1/16/89

STATIC WATER LEVEL 11.2 + CORRECTION 0.1 = 11.30 TIME 1553

ELEVATION WATER ______ REFERENCE INPUT 11.30 XD: 8.88

	Sample Number	Time (min)	SLUG IN/OUT	SLUG IN/OUT
✓	000	0.0000	13.27	
	001	0.0033	13.26	
	002	0.0067	13.24	
	003	0.0100	13.25	
	004	0.0133	13.23	
	005	0.0167	13.23	
✓	006	0.0200	13.22	
	007	0.0233	13.21	
	008	0.0267	13.20	
	009	0.0300	13.19	
✓	010	0.0333	13.18	
✓	011	0.0500	13.14	
	012	0.0667	13.10	
✓	013	0.0833	13.05	
✓	014	0.1000	13.01	
	015	0.1167	12.97	
✓	016	0.1333	12.94	
✓	017	0.1500	12.90	
✓	018	0.1667	12.87	
	019	0.1833	12.83	
✓	020	0.2000	12.80	
	021	0.2167	12.77	
	022	0.2333	12.74	
✓	023	0.2500	12.71	
	024	0.2667	12.68	
	025	0.2833	12.65	
✓	026	0.3000	12.62	
	027	0.3167	12.59	
✓	028	0.3333	12.56	
	029	0.4167	12.44	
✓	030	0.5000	12.33	
✓	031	0.5833	12.24	
✓	032	0.6667	12.17	
✓	033	0.7500	12.10	
✓	034	0.8333	12.05	
✓	035	0.9167	12.01	
✓	036	1.0000	11.97	
	037	1.0833	11.95	
	038	1.1667	11.92	
✓	039	1.2500	11.90	
	040	1.3333	11.87	
	041	1.4167	11.85	
✓	042	1.5000	11.84	
	043	1.5833	11.82	
	044	1.6667	11.81	

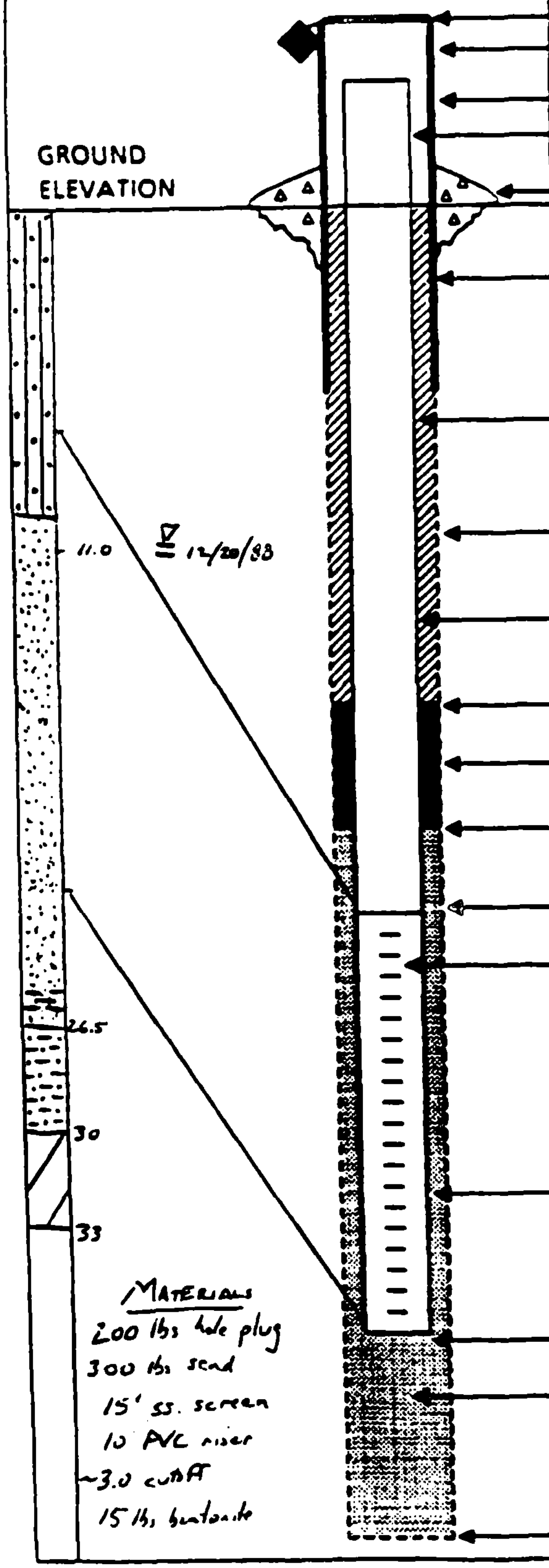
Sample Number	Time (min)	
045	1.7500	11.79
046	1.8333	11.78
047	1.9167	11.77
048	2.0000	11.76
049	2.5	11.70
050	3.0	11.66
051	3.5	11.62
052	4.0	11.59
053	4.5	11.57
054	5.0	11.55
055	5.5	11.53
056	6.0	11.51
057	6.5	11.50
058	7.0	11.48
059	7.5	11.47
060	8.0	11.46
061	8.5	11.45
062	9.0	11.44
063	9.5	11.43
064	10.0	11.42
065	12.0	11.40
066	14.0	11.38
067	16.0	11.36
068	18.0	11.35
069	20.0	11.35
070	22.0	11.34
071	24.0	11.34
072	26.0	11.33
073	28.0	11.33
074	30.0	11.33
075	32.0	
076	34.0	
077	36.0	
078	38.0	
079	40.0	
080	42.0	
081	44.0	
082	46.0	
083	48.0	
084	50.0	
085	52.0	
086	54.0	
087	56.0	
088	58.0	
089	60.0	

BORING NO.: MW 702

NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT: SHEPPARD AFB	LOCATION: WICHITA FALLS, TX	DRILLER: W. CALDWELL
PROJECT NO.: 7863	BORING: MW 702	DRILLING METHOD: AIR ROTARY
ELEVATION:	DATE: 12/10/88	DEVELOPMENT METHOD: AIR LIFT / BAILING
FIELD GEOLOGIST: J. WEDEKIND		



ELEVATION OF TOP OF SURFACE CASING: ______

ELEVATION OF TOP OF RISER PIPE: ______

STICK - UP TOP OF SURFACE CASING: 3.15

STICK - UP RISER PIPE: 2.47

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: VOLCLAY GROUT

ELEVATION / DEPTH TOP OF SEAL: 4.0

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 5.5

ELEVATION / DEPTH TOP OF SCREEN: 7.0

TYPE OF SCREEN: STAINLESS STEEL

SLOT SIZE x LENGTH: 0.010 x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20 - 40 SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 22.0

ELEVATION / DEPTH BOTTOM OF SAND PACK: 24.0

TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE PLUG (Bentonite WAFERS)

ELEVATION / DEPTH OF HOLE: 33.0

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis, Rev. 0, 2-17-89

DATE: September 12, 1989
JOB NO: 7S63
WELL NO: MW702
CALC BY: JEW

INPUT DATA (FROM DATA SHEET) (if no value, leave blank)

WELL PIPE RADIUS (ft) =	0.083
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	3.45
B (from chart) =	0.55
C (from chart) =	0
D, DEPTH TO IMPERMEABLE BOUNDARY (ft) =	17.67
Dd, = ln((D-H)/Rw) =	2.3
H, HEIGHT OF WELL BELOW WATER TABLE (ft) =	15.17
L, HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	15.17
Rw, RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T, TIME IN SECONDS (Tt-To) =	30
Yo, STARTING Y (ft) =	1.03
Yt, ENDING Y (ft) =	0.67

CALCULATE Rc

Rc = 0.069442

CONDITION 1, PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.893279

CONDITION 2, FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.732376

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW,
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING, ln(Re/Rw) = 2.893279
FULLY PENETRATING, ln(Re/Rw) = 3.732376

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.893279

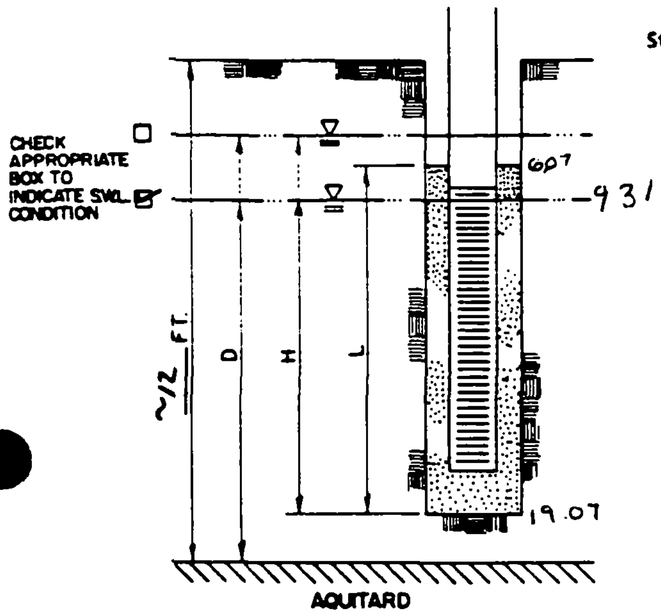
CALCULATION

K in ft/sec = 6.59E-06

K in cm/sec = 2.01E-04

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE:	SHEPPARD AFB	TEST BY/DATE:	P. Pogue 1/12/89
JOB NUMBER:	7863	CALCULATED BY/DATE:	J. Wedekind 2/7/89
WELL NUMBER:	MW-801	CHECKED BY/DATE:	9/8/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 9.31 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 6.07 ft. B.T.O.C.

Bott. Filter Pack = 19.07 ft. B.T.O.C.

Screen Length = 10 ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.57 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 9.76 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 9.76 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 9.76 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = ~4, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$\boxed{1.51 \times 10^{-3} \text{ cm/sec}}$

* If s.w.l. is below top of screen, then L = H.

** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 39.04).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 39.04).

C = 2.40 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.25 , T_t = 0.83 , Y_o = 1.47 , Y_t = 0.87

$$T = T_t - T_o = 34.8 \text{ (sec)}$$

Complete Page 5 in its entirety.

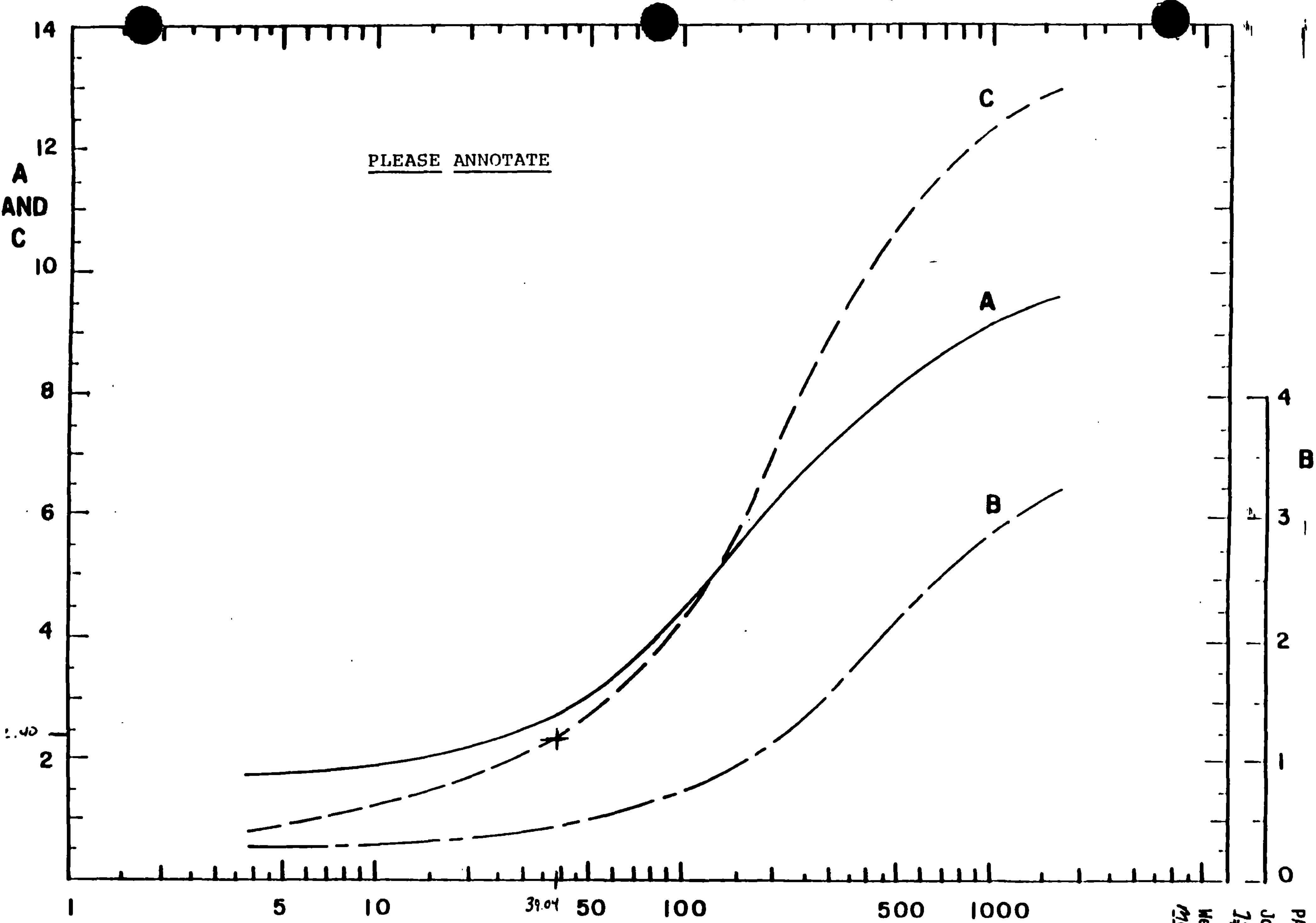


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L/Rw

PAGE 3
Job No. 7563
Well No MW801

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	2.01	2.00	0.57		
	0.03	1.91	2.50	0.51		
	0.05	1.86	3.0	0.47		
	0.08	1.78				
	0.10	1.74				
	0.13	1.67				
	0.15	1.64				
	0.167	1.61				
	0.20	1.55				
x_0	0.25	1.47				
	0.30	1.39				
	0.33	1.35				
	0.42	1.24				
	0.50	1.14				
	0.58	1.06				
	0.67	0.99				
	0.75	0.93				
x_t	0.83	0.87				
	0.91	0.83				
	1.00	0.79				
	1.25	0.71				
	1.50	0.65				
	1.75	0.61				

Job No. 7563
Well No. MW001

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = NA (N/A if not applicable)

B (from chart) = NA (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 2.40 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 9.76

$D_d = \ln[(D - H)/Rw]$ = NA (must be ≤ 6)

H, Height of Well Below Water Table (ft) = 9.76

L, Height Through Which Water Enters Well (ft) = 9.76

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds $(T_t - T_o)$ = 34.8

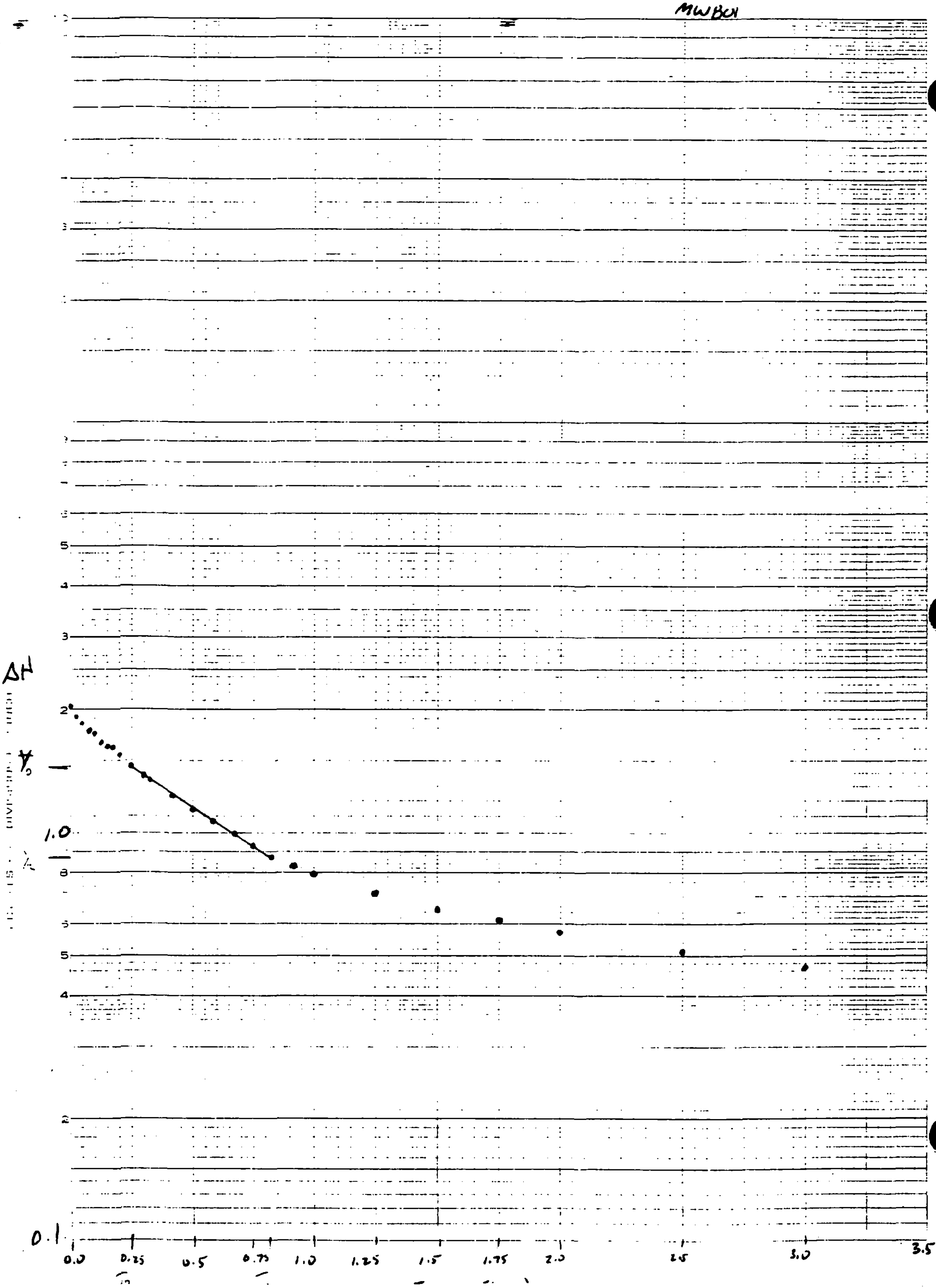
Y_o, Starting Y (ft) = 1.47

Y_t, Ending Y (ft) = 0.87

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Used bottom of sand pack as depth to impermeable boundary because well is screened into this interval.

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

7$63
MWBOI



SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW801
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	2.4
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	9.76
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	9.76
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	9.76
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	34.8
Yo. STARTING Y (ft) =	1.47
Yt. ENDING Y (ft) =	0.87

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.331442

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 2.765137

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 3.331442
FULLY PENETRATING. ln(Re/Rw) = 2.765137

THE CORRECT VALUE OF ln(Re/Rw) IS: 2.765137

CALCULATION

K in ft/sec = 4.96E-05

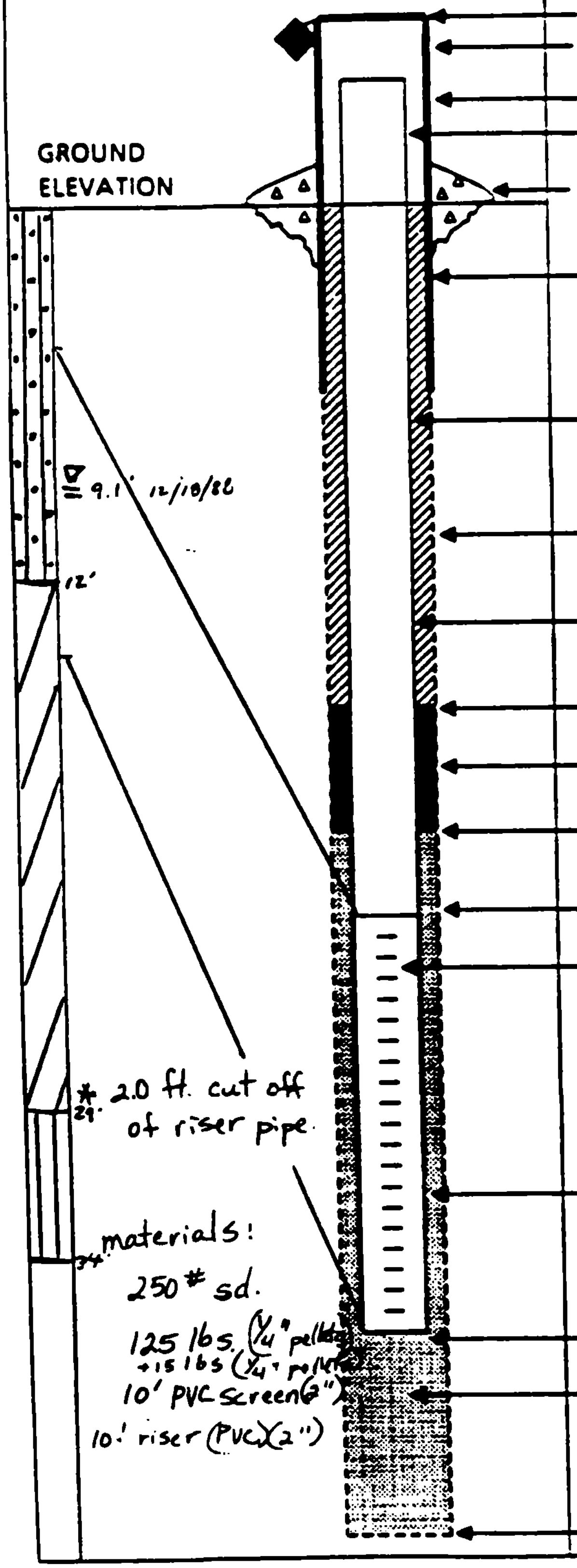
K in cm/sec = 1.51E-03

NUS CORPORATION

BORING NO.: MW-801

OVERBURDEN MONITORING WELL SHEET

PROJECT Sheppard AFB	LOCATION Wichita Falls, Tx.	DRILLER W. Caldwell
PROJECT NO. 7863	BORING MW-801	DRILLING METHOD Air Rotary
ELEVATION	DATE 12-07-88	DEVELOPMENT METHOD Air Lift
FIELD GEOLOGIST P. POGUE, T. Wedekind		



ELEVATION OF TOP OF SURFACE CASING: ______

ELEVATION OF TOP OF RISER PIPE: ______

STICK - UP TOP OF SURFACE CASING: 2.78

STICK - UP RISER PIPE: 2.57

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: STEEL

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay grout

ELEVATION / DEPTH TOP OF SEAL: 2.5

TYPE OF SEAL: 1/4" bentonite pellets

DEPTH TOP OF SAND PACK: 3.5'

ELEVATION / DEPTH TOP OF SCREEN: 4.5'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 silica sand.

ELEVATION / DEPTH BOTTOM OF SCREEN: 14.5'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 16.5'

TYPE OF BACKFILL BELOW OBSERVATION WELL: Hole plug to 29.5
Caving to T.D.

ELEVATION / DEPTH OF HOLE: 34.0

Display 0

NUS CORPORATION

WELL No.: MW801 ELEVATION: ______ DATE: 1/12/89

STATIC WATER LEVEL 9.04 + CORRECTION .2 = 9.24 TIME 13:40

ELEVATION WATER ______ REFERENCE INPUT 9.24 XD: 7.51

9.24 + 7.51 = 16.75

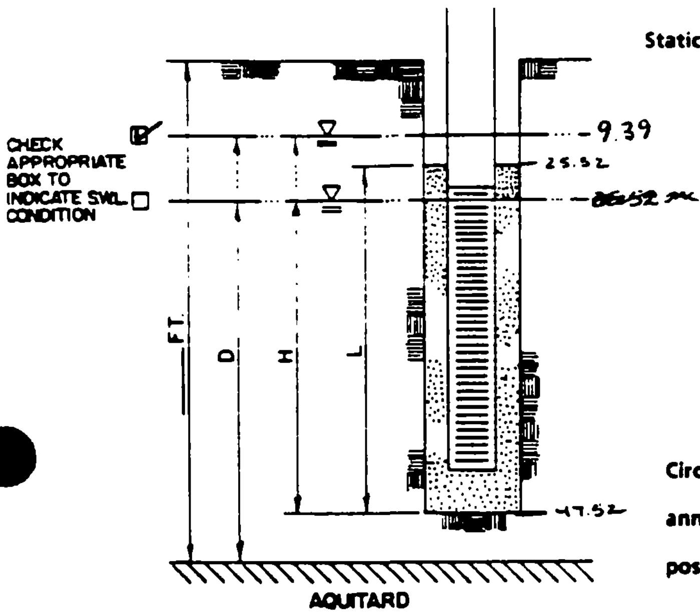
	Sample Number	Time (min)	T.D. 17.61 (TOC) SLUG IN/OUT	9.31 - reference input SLUG IN/OUT 10:18
				~~11.32~~ (1st)
✓	000	0.0000		11.32
	001	0.0033		11.30
	002	0.0067		11.28
	003	0.0100		11.28
	004	0.0133		11.27
	005	0.0167		11.25
	006	0.0200		11.25
	007	0.0233		11.24
	008	0.0267		11.23
✓	009	0.0300		11.22
	010	0.0333		11.22
✓	011	0.0500		11.17
	012	0.0667		11.13
	013	0.0833		11.09
	014	0.1000		11.05
	015	0.1167		11.02
	016	0.1333		10.98
	017	0.1500		10.95
	018	0.1667		10.92
	019	0.1833		10.89
	020	0.2000		10.86
	021	0.2167		10.83
	022	0.2333		(1st) 10.81
	023	0.2500		10.78
	024	0.2667		10.75
	025	0.2833	9.20	10.73
	026	0.3000	9.20	10.70
	027	0.3167	9.20	10.68
	028	0.3333	9.20	10.66
	029	0.4167	8.72	10.55
	030	0.5000	11.24	10.45
	031	0.5833	11.28	10.37
	032	0.6667	10.60	10.30
	033	0.7500	10.46	10.24
	034	0.8333	10.33	10.18
	035	0.9167	10.23	10.14
	036	1.0000	10.13	10.10
	037	1.0833	10.05	10.07
	038	1.1667	9.98	10.05
	039	1.2500	9.92	10.02
	040	1.3333	9.87	10.00
	041	1.4167	9.82	9.98
	042	1.5000	9.78	9.96
	043	1.5833	9.75	9.95
	044	1.6667	9.72	9.93

Sample Number	Time (min)			
045	1.7500	9.70		9.92
046	1.8333	9.68		9.91
047	1.9167	9.67		9.89
048	2.0000	9.65		9.88
049	2.5	9.60		9.82
050	3.0	9.56		9.78
051	3.5	9.53		9.75
052	4.0	9.51		9.71
053	4.5	9.50		9.69
054	5.0	9.48		9.67
055	5.5	9.47		9.65
056	6.0	9.46		9.63
057	6.5	9.45		9.62
058	7.0	9.44		9.61
059	7.5	9.43		9.59
060	8.0	9.43		9.58
061	8.5	9.42		9.57
062	9.0	9.42		9.56
063	9.5	9.41		9.55
064	10.0	9.40		9.53
065	12.0	9.38		9.50
066	14.0	9.37		9.47
067	16.0	9.36		9.45
068	18.0	9.35		9.43
069	20.0	9.34		9.42
070	22.0	9.33		9.41
071	24.0	9.32	~~9.39~~	9.39
072	26.0	9.32		9.38
073	28.0	9.31		9.38
074	30.0	9.31		9.37
075	32.0			9.36
076	34.0			9.365 PSP
077	36.0			9.35
078	38.0			
079	40.0			
080	42.0			
081	44.0			
082	46.0			
083	48.0			
084	50.0			
085	52.0			
086	54.0			
087	56.0			
088	58.0			
089	60.0			

INPUT DATA FOR 123/SLUGCALC PROGRAM, REV. 0
HYDRAULIC CONDUCTIVITY CALCULATION FOR SLUG TEST
BOUWER-RICE METHODOLOGY (1976)

JOB SITE: Sheppard AFB
JOB NUMBER: 7563
WELL NUMBER: AW11-1

TEST BY/DATE: P. Pogue 1/15/88
CALCULATED BY/DATE: J. Weddle 2/7/89
CHECKED BY/DATE: TAC 9/8/89



Well Construction Details
(attach boring log and well completion form)

Static Water Level (S.W.L.) = 9.39 ft. (below top of casing) B.T.O.C.

Top Filter Pack = 25.52 ft. B.T.O.C.

Bott. Filter Pack = 47.52 ft. B.T.O.C.

Screen Length = 15' ft.

Borehole Radius = 0.25 ft.

Well Pipe Radius = 0.08 ft.

Stickup = 2.52 ft. above/below grade

Filter Pack Porosity = 0.30

Circle type of well: fully/partially penetrating. If fully penetrating annotate drawing appropriately (i.e., show the aquitard and its position relative to L, H, D, etc.)

DEFINE:

L = HEIGHT THROUGH WHICH WATER ENTERS WELL/AQUIFER = 22.0 (ft)*

H = HEIGHT OF WELL BELOW WATER TABLE = 38.13 (ft)

D = DEPTH TO IMPERMEABLE BOUNDARY = 38.13 (ft)**

R_w = RADIUS FROM WELL CENTER TO UNDISTURBED AQUIFER = 0.25 (ft)

D_d = $\ln[(D - H)/R_w]$ = D=H, if >6 USE 6 HERE, AND AS THE INPUT VALUE FOR D_d ON THE INPUT DATA PAGE

$K = 2.00 \times 10^{-5}$ cm/sec

* If s.w.l. is below top of screen, then L = H.
** Based on knowledge of site geology.

CONDITION #1, IF D > H (i.e., well partially penetrating, use Figure 1 to find A & B values using L/R_w = 88).

A = NA B = NA (N/A if not applicable).

CONDITION #2, IF D = H (i.e., well fully penetrating, use Figure 1 to find C value using L/R_w = 88).

C = 4.0 (N/A if not applicable).

Please show your work on Figure 1.

Go to Page 4 and plot field data as instructed.

Obtain T_o, Y_o (beginning), T_t, and Y_t (end) from straight line portion of plot (attach plot at back).

T_o = 0.30 , T_t = 2.00 , Y_o = 1.82 , Y_t = 1.74

$$T = T_t - T_o = \underline{\ 162\ } \text{ (sec)}$$

Complete Page 5 in its entirety.

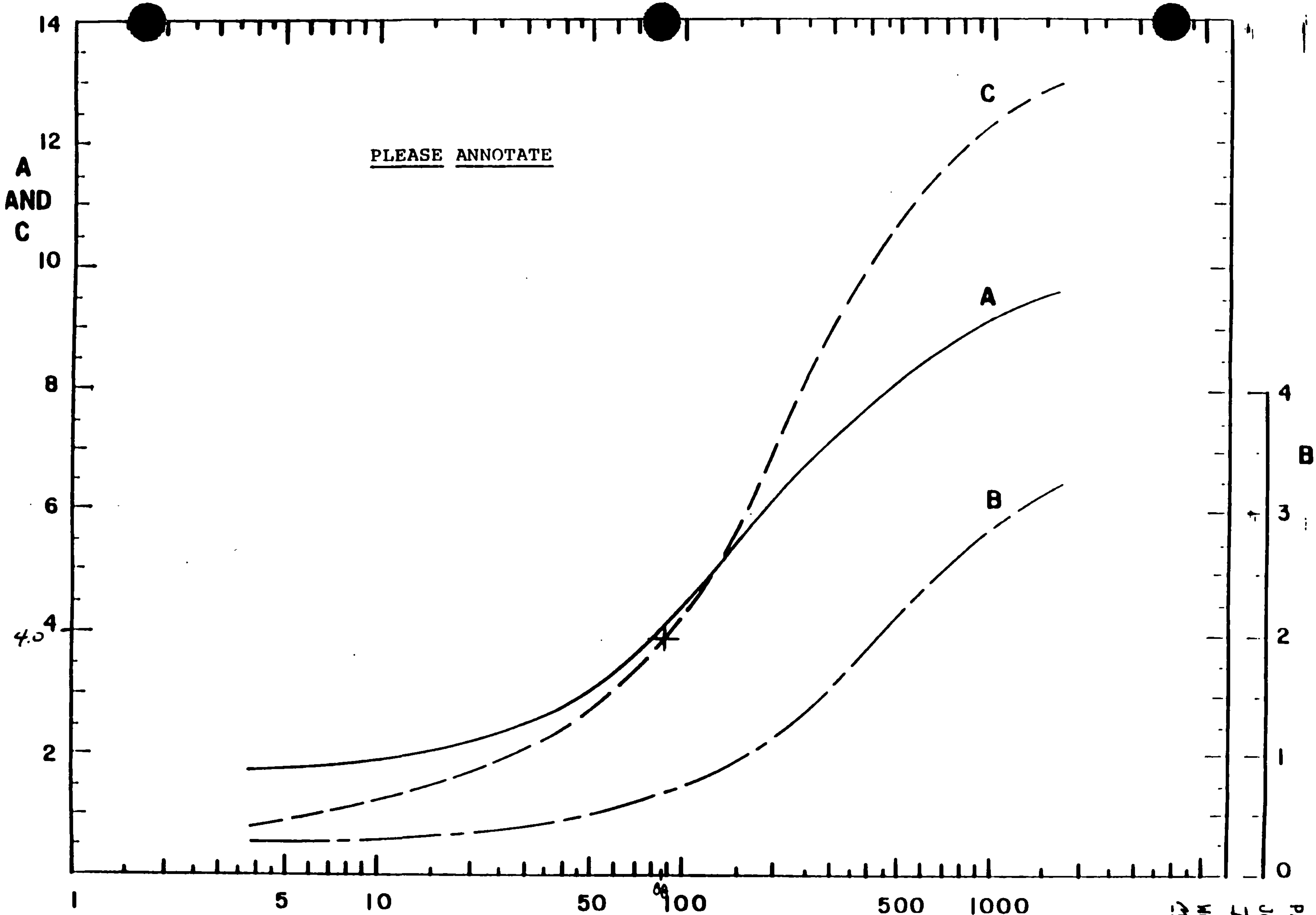


FIGURE 1 CURVES RELATING COEFFICIENTS A, B, AND C TO L / Rw

PAGE 3
Job No.
Well No

Job No. [illegible]
Well No. MW11

PLOT y versus t (from field data, attached at back):

where:

t = time measured in field during slug test

y = depth to static water table minus depth to falling water level (for slug injection)

or

y = depth to rising water level minus depth to static water table (for slug removal)

Plot t on x-axis (arithmetic scale)

Plot y on y-axis (log scale)

Interpret aquifer response. Return to Page 2 and complete as instructed.

	t = 0 t (min.)	S.W.L. = 9.39 y (feet)	t (min.)	y (feet)	t (min.)	y (feet)
	0.00	1.97				
	0.05	1.97				
	0.10	1.90				
	0.20	1.84				
X_o	0.30	1.82				
	0.50	1.81				
	1.00	1.79				
	1.50	1.77				
X_t	2.00	1.76				
	3.00	1.74				
	4.00	1.73				
	5.00	1.71				
	6.00	1.70				
	7.00	1.68				

INPUT DATA

(FOR 123/SLUGCALC PROGRAM, REV. 0)

Well Radius (ft) = 0.08

Boring Radius (ft) = 0.25

Filter Pack Porosity = 0.30

PARTIALLY PENETRATING WELL:

A (from chart) = N/A (N/A if not applicable)

B (from chart) = N/A (N/A if not applicable)

FULLY PENETRATING WELL:

C (from chart) = 4.0 (N/A if not applicable)

D, Depth to Impermeable Boundary (ft) = 38.13

D_d = ln[(D - H)/Rw] = D=H (must be ≤6)

H, Height of Well Below Water Table (ft) = 38.13

L, Height Through Which Water Enters Well (ft) = 22.0

Rw, Radius from Well Center to Aquifer (ft) = 0.25

T, Time in seconds (T_t - T_o) = 102

Y_o, Starting Y (ft) = 1.82

Y_t, Ending Y (ft) = 1.76

COMMENTS (EXPLAIN ANY IRREGULARITIES OR RATIONALE THAT ARE NOT OBVIOUS; USE SKETCHES IF NECESSARY): Due to very low apparent permeability of clay, used the bottom of sand pack as depth to impermeable boundary.
Test may not have been run long enough (74 min.).

Go to one of the PCs and call up Lotus 123. Use the slash (/) key to access the menu. Retrieve the 123/SLUGCALC file. Use the input data on this sheet to find K then use the (PrtSc) or (PRINTSCREEN) key to get a copy of the calculation. Attach copy to back of this packet. DO NOT save your calculation file as /SLUGCALC. DO NOT save your calculation file on the Hard Disk.

SLUG TEST FORMULA CALCULATIONS
by: Allan Jenkins and Jonathan Lewis. Rev. 0. 2-17-89

DATE: MARCH 24. 1989
JOB NO: 7563
WELL NO: MW11-1
CALC BY: JAMES WEDEKIND

INPUT DATA (FROM DATA SHEET) (if no value. leave blank)

WELL PIPE RADIUS (ft) =	0.08
BORING RADIUS (ft) =	0.25
FILTER PACK POROSITY =	0.3
A (from chart) =	
B (from chart) =	
C (from chart) =	4
D. DEPTH TO IMPERMEABLE BOUNDARY (ft) =	38.13
Dd. = ln((D-H)/Rw) =	
H. HEIGHT OF WELL BELOW WATER TABLE (ft) =	38.13
L. HEIGHT THROUGH WHICH WATER ENTERS WELL (ft) =	22
Rw. RADIUS FROM WELL CENTER TO AQUIFER (ft) =	0.25
T. TIME IN SECONDS (Tt-To) =	102
Yo. STARTING Y (ft) =	1.82
Yt. ENDING Y (ft) =	1.76

CALCULATE Rc

Rc = 0.152413

CONDITION 1. PARTIALLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 4.570268

CONDITION 2. FULLY PENETRATING WELL

CALCULATE ln(Re/Rw)

ln(Re/Rw) = 3.784151

FIND HYDRAULIC CONDUCTIVITY (K)

NOW YOU MUST ENTER THE CORRECT VALUE FOR ln(Re/Rw) BELOW.
DEPENDING ON WHETHER THE WELL IS PARTIALLY OR FULLY PENETRATING

PARTIALLY PENETRATING. ln(Re/Rw) = 4.570268
FULLY PENETRATING. ln(Re/Rw) = 3.784151

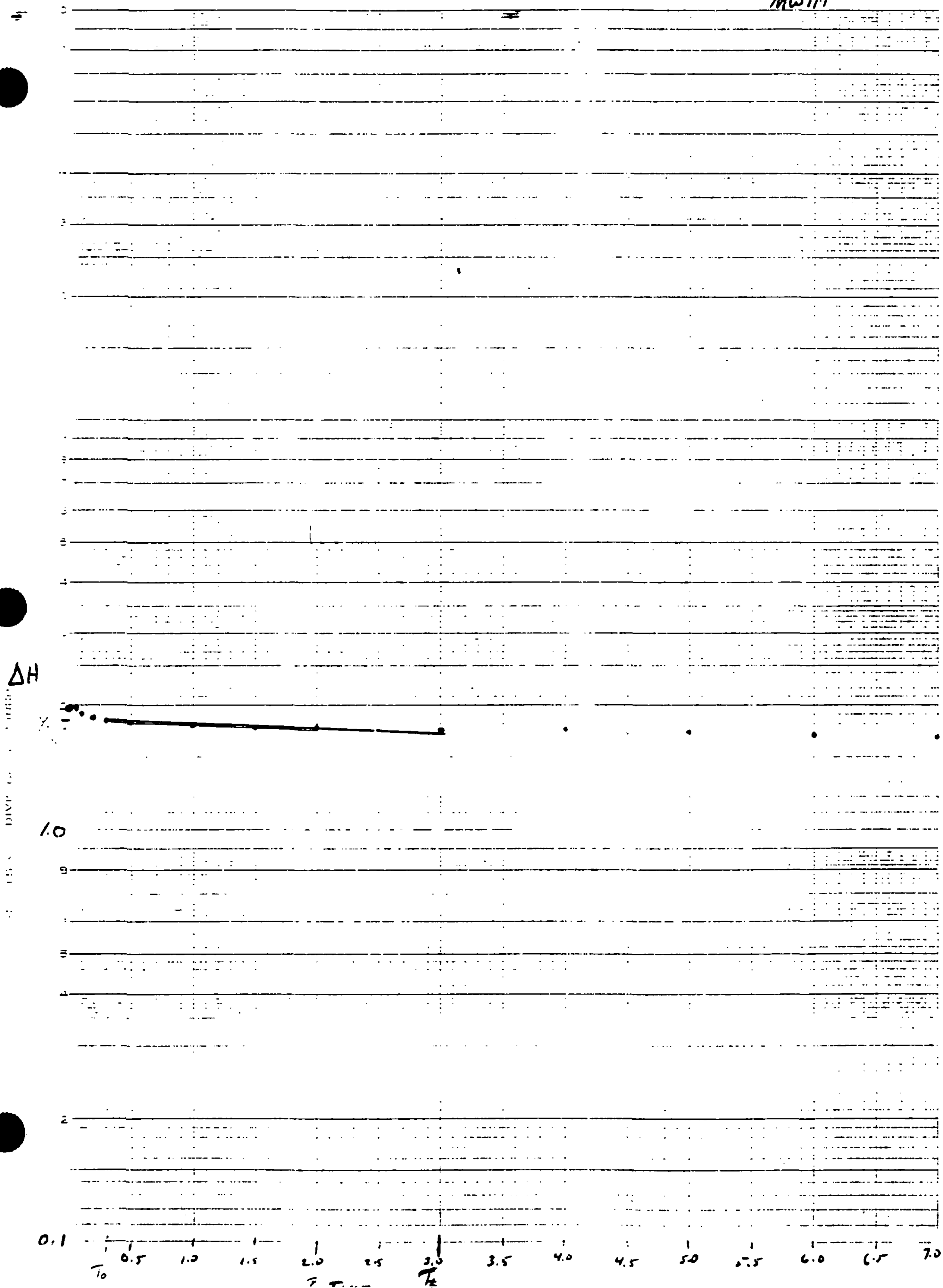
THE CORRECT VALUE OF ln(Re/Rw) IS: 3.784151

CALCULATION

K in ft/sec = 6.57E-07

K in cm/sec = 2.00E-05

MW11-1



BORING NO.: MW11-1

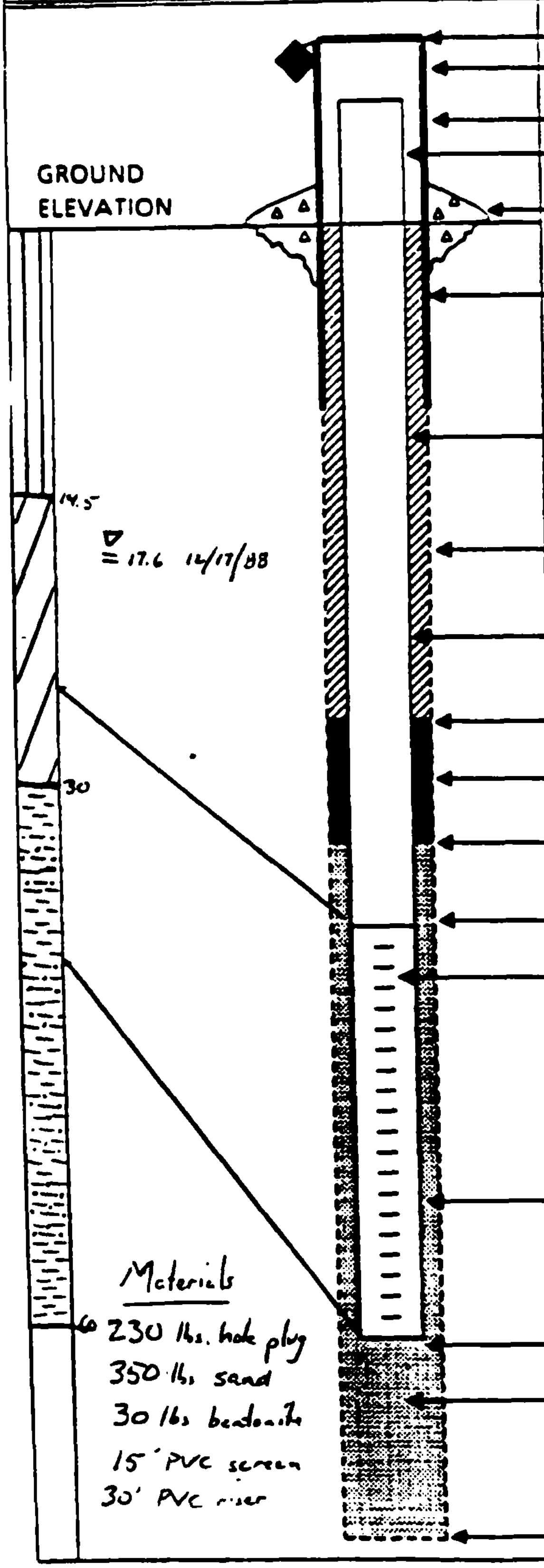
NUS CORPORATION

OVERBURDEN
MONITORING WELL SHEET

PROJECT Sheppard AFB
PROJECT NO. 7563
ELEVATION —
FIELD GEOLOGIST J. Wedekind, P. Pogue

LOCATION Wichita Falls, TX
BORING MW11-1
DATE 12/13/88

DRILLER W. Caldwell
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD Air Lift / Bailing



ELEVATION OF TOP OF SURFACE CASING :

ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING: 2.73

STICK - UP RISER PIPE : 2.52

TYPE OF SURFACE SEAL: Concrete Pad

I.D. OF SURFACE CASING: 6"

TYPE OF SURFACE CASING: Steel x 5'

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 6"

TYPE OF BACKFILL: Volclay Grout

ELEVATION / DEPTH TOP OF SEAL: 20

TYPE OF SEAL: Bentonite Pellets (1/4")

DEPTH TOP OF SAND PACK: 23

ELEVATION / DEPTH TOP OF SCREEN: 25

TYPE OF SCREEN: Schedule 40 PVC

SLOT SIZE x LENGTH: 0.010" x 15'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20-40 Silica Sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 40

ELEVATION / DEPTH BOTTOM OF SAND PACK: 45

TYPE OF BACKFILL BELOW OBSERVATION WELL: "Hole Plug" (Bentonite Wafers) to 45'

ELEVATION / DEPTH OF HOLE: 60

Materials
230 lbs. hole plug
350 lbs. sand
30 lbs. bentonite
15' PVC screen
30' PVC riser

Display 2 50psi XD

NUS CORPORATION

WELL No.: MW11-1 ELEVATION: ______ DATE: 1/15/89

STATIC WATER LEVEL 9.29 + CORRECTION 0.1 = 9.39 TIME .095[illegible]

ELEVATION WATER ______ REFERENCE INPUT 9.39 XD 31.0'

	Sample Number	Time (min)	SLUG IN/OUT			SLUG IN/OUT
✓	000	0.0000	11.36	[illegible]	14.40	
	001	0.0033	11.21	25.70	14.49	
	002	0.0067	11.28	25.72	[illegible]	
	003	0.0100	11.45	[illegible]	14.49	
	004	0.0133	11.48	25.97	14.4[illegible]	
	005	0.0167	11.37	25.86	14.49	
	006	0.0200	11.24	25.73	14.49	
	007	0.0233	11.26	25.75	14.49	
	008	0.0267	11.37	25.86	14.49	
	009	0.0300	11.42	25.91	14.49	
	010	0.0333	11.37	25.86		
✓	011	0.0500	11.36	25.84		
	012	0.0667	11.34	25.83		
	013	0.0833	11.31	25.79		
✓	014	0.1000	11.29	25.73		
	015	0.1167	11.28	25.76	14.48	
	016	0.1333	11.26	25.75	14.49	
	017	0.1500	11.24	25.73		
	018	0.1667	11.24	25.73		
	019	0.1833	11.24	25.73		
✓	020	0.2000	11.23	25.72		
	021	0.2167	11.23	25.72		
	022	0.2333	11.23	25.72		
	023	0.2500	11.23	25.72		
	024	0.2667	11.23	25.72		
	025	0.2833	11.21	25.70		
✓	026	0.3000	11.21	25.70		
	027	0.3167	11.21	25.70		
	028	0.3333	11.21	25.70		
	029	0.4167	11.21	25.70		
✓	030	0.5000	11.20	25.68	14.48	
	031	0.5833	11.20	25.68		
	032	0.6667	11.20	25.68		
	033	0.7500	11.18	25.67	14.49	
	034	0.8333	11.18	25.67		
	035	0.9167	11.18	25.67		
✓	036	1.0000	11.18	25.67		
	037	1.0833	11.18	[illegible]		
	038	1.1667	11.16	[illegible]		
	039	1.2500	11.16	25.65		
	040	1.3333	11.16	25.65		
	041	1.4167	11.16	25.65		
✓	042	1.5000	11.16	25.65		
	043	1.5833	11.16	25.65		
	044	1.6667	11.16	[illegible]		

	Sample Number	Time (min)			
	045	1.7500	11.16	25.65	4.49
	046	1.8333	11.15	25.64	
	047	1.9167	11.15	25.64	
✓	048	2.0000	11.15	25.64	
	049	2.5	11.13	25.62	
✓	050	3.0	11.13	25.62	
	051	3.5	11.12	25.60	49
✓	052	4.0	11.12	25.60	14.48
	053	4.5	11.10	25.59	14.49
✓	054	5.0	11.10	25.59	14.49
	055	5.5	11.09	25.57	14.48
✓	056	6.0	11.09	25.57	
	057	6.5	11.09	25.57	
✓	058	7.0	11.07	25.56	4.49
	059	7.5	11.07	25.56	
	060	8.0	11.07	25.56	
	061	8.5	11.07	25.56	
	062	9.0	11.05	25.54	
	063	9.5	11.05	25.54	
	064	10.0	11.05	25.54	
	065	12.0	11.04	25.52	4.48
	066	14.0	11.02	25.51	4.49
	067	16.0	11.02	25.51	
	068	18.0	11.01	25.49	4.48
	069	20.0	10.99	25.48	14.49
	070	22.0	10.99	25.48	
	071	24.0	10.97	25.46	
	072	26.0	10.97	25.46	
	073	28.0	10.96	25.45	
	074	30.0	10.96	25.45	
	075	32.0	10.94	25.43	
	076	34.0	10.94	25.43	
	077	36.0	10.94	25.43	
	078	38.0	10.93	25.41	14.48
	079	40.0	10.93	25.41	
	080	42.0	10.93	25.41	
	081	44.0	10.91	25.40	4.49
	082	46.0	10.91	25.40	
	083	48.0	10.91	25.40	
	084	50.0	10.91	25.40	
	085	52.0	10.89	25.38	
	086	54.0	10.89	25.38	
	087	56.0	10.89	25.38	
	088	58.0	10.89	25.38	
	089	60.0	10.88	25.37	

Sample Number	Time (min			
090	62.0	10.88	25.37	14.49
091	64.0	10.88	25.37	
092	66.0	10.88	25.37	
093	68.0	10.88	25.37	
094	70.0	10.86	25.35	
095	72.0	10.86	25.35	
096	74.0	10.86	25.35	14.49
097	76.0			
098	78.0			
099	80.0			
100	82.0			
101	84.0			
102	86.0			
103	88.0			
104	90.0			
105	92.0			
106	94.0			
107	96.0			
108	98.0			
109	100.0			
110	110			
111	120			
112	130			
113	140			
114	150			
115	160			
116	170			
117	180			
118	190			
119	200			
120	210			
121	220			
122	230			
123	240			
124	250			
125	260			
126	270			
127	280			
128	290			
129	300			
130	310			
131	320			
132	330			
133	340			
134	350			

D

APPENDIX D

SOIL GAS SURVEYS

SOIL GAS SURVEY

The following is a report issued by Target Environmental Services, Inc. for a soil gas survey conducted at sites FT01, FT03, and LF04. When the investigation was conducted, however, these sites were referred to as follows:

- FT01 -- FPTA-1
- FT03 -- FPTA-3
- LF04 -- LF-1

Refer to these numbers when reading this report.

SOIL GAS SURVEY

SHEPPARD AIR FORCE BASE

WICHITA FALLS, TEXAS

PREPARED FOR

NUS CORPORATION

800 OAK RIDGE TURNPIKE

JACKSON PLAZA C-200

OAK RIDGE, TENNESSEE 37830

PREPARED BY

TARGET ENVIRONMENTAL SERVICES, INC.

OAKLAND CENTER

8940-A ROUTE 108

COLUMBIA, MARYLAND 21045

(301) 992-6622

NOVEMBER 1988

EXECUTIVE SUMMARY

On November 8 and 9, 1988, **TARGET** Environmental Services, Inc. (**TARGET**) conducted a soil gas survey at three areas within the Sheppard Air Force Base in Wichita Falls, Texas. Two of the areas surveyed were previously used as fire training pits (FPTA-1 and FPTA-3) and are now parts of a golf course, and the third area is a landfill (LF-1). Analysis of the samples by GC/FID revealed the presence of subsurface hydrocarbon vapors in the vicinity of the two fire training pits. Elevated levels at the FPTA-1 site were present in only one sample at the northeast corner of the site. The chromatogram signature of this sample is indicative of diesel fuel. Full delineation of this occurrence, however, is precluded due to its location on the perimeter of the surveyed area. The occurrence observed at the FPTA-3 site extends from the southwest corner of the site to the northeast corner of the surveyed area. The chromatograms of these samples contain small scattered peaks, indicative of residual petroleum-hydrocarbon contamination.

Analysis of the samples by GC/ECD revealed the presence of trichloroethylene in only one sample (Sample 206), at the FPTA-1 site. The TCE concentration is this sample is relatively low and is not indicative of severe contamination. No other chlorinated hydrocarbons were present in the soil gas samples collected.

Introduction

Low levels of halogenated and non-halogenated hydrocarbons have been measured in monitoring wells at the Sheppard Air Force Base in Wichita Falls, Texas. **NUS Corporation** contracted **TARGET** Environmental Services, Inc. (**TARGET**) to perform a soil gas survey to assess certain portions of the site for subsurface hydrocarbon contamination. Two of the areas surveyed were previously used as fire training areas (FPTA-1 and FPTA-3) and are now parts of a golf course, and the third area was a landfill (LF-1). The field phase of this survey was conducted on November 8 and 9, 1988.

Detectability

The soil gas survey data presented in this report are the result of precise sampling and measurement of contaminant concentrations in the vadose zone. Analyte detection at a particular location is representative of vapor, dissolved, and/or liquid phase contamination at that location. The presence of detectable levels of target analytes in the vadose zone is dependent upon several factors, including the presence of vapor-phase hydrocarbons or dissolved or liquid concentrations adequate to facilitate volatilization into the unsaturated zone.

Terminology

In order to prevent misunderstanding of certain terms used in this report, the following clarifications are offered:

The term "feature" is used in reference to a discernable pattern in the contoured data. It denotes a contour form rather than a definite or separate chemical occurrence.

The term "occurrence" is used to indicate an area where chemical compounds are present in sufficient concentrations to be detected by the analysis of soil vapors. The term is not indicative of any specific mode of occurrence (vapor, dissolved, etc), and does not necessarily indicate or suggest the presence of "free product" or "phase-separated hydrocarbons".

The term "trace level" represents a concentration that is detectable but is less than the formal detection limit of the analytical equipment. A statistically valid quantification of trace levels is not possible.

Field Procedures

Soil gas samples were collected at a total of 80 locations at the site, as shown in Figures 1 through 4. To collect the samples a 1/2 inch hole was produced to a depth of three to four feet by using a slide hammer. The entire sampling system was purged with ambient air through a dust and organic vapor filter cartridge, and a stainless steel probe was inserted to the full depth of the hole and sealed off from the atmosphere. A sample of in-situ soil gas was then withdrawn through the probe and used to purge atmospheric air from the sampling system. A second sample of soil gas was withdrawn through the probe and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure (15 psig). The self-sealing vial was detached from the sampling system, packaged, labeled, and stored for laboratory analysis.

Prior to each day's field activities all sampling equipment, slide hammer rods, and probes were decontaminated by washing with soapy distilled water and rinsing with distilled water. Internal surfaces were flushed dry using pre-purified nitrogen, and external surfaces were wiped clean using clean paper towels.

Field control samples were collected at the beginning of each day's field activities, after every twentieth soil gas sample, and at the end of each day's field activities. These QA/QC samples were obtained by filtering ambient air through a dust and organic vapor filter cartridge and collecting in the same manner as described above.

Laboratory Procedures

Fifty-four of the samples collected during the field phase of the survey were subjected to dual analyses. The samples which were to be analyzed were specified by the client, and the remaining samples were not analyzed. One analysis was conducted according to EPA Method 601 on a gas chromatograph equipped with an electron capture detector (ECD), but using direct injection instead of purge and trap. Specific analytes standardized for this analysis were:

1,1-dichloroethene (11DCE)
trans-1,2-dichloroethene (t-12DCE)
1,1-dichloroethane (11DCA)
1,1,1-trichloroethane (111TCA)
1,1,2-trichloroethene (TCE)
1,1,2-trichloroethane (112TCA)
1,1,2,2-tetrachloroethene (PCE)
1,1,2,2-tetrachloroethane (TECA)

The chlorinated hydrocarbons in this suite were chosen because of their common usage in industrial solvents, and/or their degradational relationship to commonly used compounds.

The second analysis was conducted according to EPA Method 602 on a gas chromatograph equipped with a flame ionization detector (FID), but using direct injection instead of purge and trap. The analytes selected for standardization in this analysis were:

methyl tertiary butyl ether (MTBE)
benzene
toluene
ethylbenzene
meta- and para- xylene
ortho-xylene

These compounds were chosen because of their utility in evaluating the presence of fuel products, or petroleum based solvents.

FID Total Volatiles values were generated by summing the areas of all chromatogram peaks, and calculating using the instrument response factor for toluene. Injection peaks, which also contain the light hydrocarbon methane, were excluded to avoid the skewing of the Total Volatiles (Totals) values due to injection disturbances and biogenic methane.

The analytical equipment was calibrated using an instrument-response curve and injection of known concentrations of the above standards. Retention times of the standards were used to identify the peaks in the chromatograms of the field samples, and their response factors were used to calculate the analyte concentrations. The tabulated results of the laboratory analyses of the soil gas samples are given in Tables 1 and 2. Because pentane and MTBE co-elute, they are listed together in the table.

For QA/QC purposes, a duplicate analysis was performed on every tenth field sample. Laboratory syringe blanks of carrier gas were also analyzed.

Discussion and Interpretation of Results

In order to provide graphic presentation of the results, individual data sets in Tables 1 and 2 have been mapped and contoured to produce Figures 1 through 5. Dashed contours are used where patterns are extrapolated into areas of less complete data.

LF-1

The only hydrocarbons detected at the landfill area were at Station 1 (see Figure 1) and these levels were very low. No evidence was seen of significant hydrocarbon contamination in the landfill area LF-1.

FPTA-3

Elevated levels were observed in several areas of the FPTA-3 site. The highest calculated Total Volatiles level (129 ug/l) is at Station 101, at the southwest corner of the site (see Figure 2). Values trend northeastward to evaporation pit and extend to the northeastern corner of the surveyed area. Continuity of the mapped feature across the evaporation pit cannot be determined due to limited data in that area. The chromatograms for samples at FPTA-3 contain small scattered peaks, indicative of residual contamination. Pentane/MTBE (Figure 3) data formed a one-point anomaly at Station 101, where the highest Total Volatiles concentration was observed. Toluene and ethylbenzene (not individually mapped) were also observed at Station 101, in patterns similar to pentane/MTBE.

FPTA-1

The Total Volatiles map for the FPTA-1 site (Figure 4) shows elevated hydrocarbon levels at the northeastern corner of the area surveyed (Station 203). Pentane/MTBE, toluene, ethylbenzene, meta- and para-xylene and ortho-xylene were also detected only in Sample 203 (in order to avoid redundancy, the individual maps for these analytes are not included). The peak retention times and the chromatogram signature of Sample 203 are indicative of diesel fuel. The full extent of the occurrence is not defined due its location at the perimeter of the surveyed area.

Sample 206 was the only sample in the three areas which contained chlorinated hydrocarbons. Trichloroethylene (TCE) (Figure 5) was the only chlorinated hydrocarbon present at that station, and at relatively low concentrations (1.1 ug/l). This single-point low-level anomaly is not indicative of significant TCE contamination at the site.

TABLE 1

LABORATORY RESULTS
FLAME IONIZATION DETECTOR ANALYSIS
CONCENTRATIONS IN MICROGRAMS-PER-LITER

SAMPLE	PENTANE/ MTBE[1]	BENZENE	TOLUENE	ETHYL-BENZENE	m- & p-XYLENE	o-XYLENE	TOTAL VOLATILES[2]
1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
12	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
14	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
15	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
17	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
101	10	<1.0	1.9	1.6	<1.0	<1.0	129
103	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.0
104	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1
106	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.7
111	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
113	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	35
116	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	30
118	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8
120	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
122	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
123	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
125	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.8
128	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	16
201	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
202	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
203	86	<1.0	14	6.8	6.0	2.0	818
204	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
205	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
206	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
207	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
208	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
209	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
210	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

[1]CONCENTRATIONS BASED ON RESPONSE FACTOR OF MTBE

[2]CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS, AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE

TABLE 1 (cont)

LABORATORY RESULTS
FLAME IONIZATION DETECTOR ANALYSIS
CONCENTRATIONS IN MICROGRAMS-PER-LITER

SAMPLE	PENTANE/ MTBE[1]	BENZENE	TOLUENE	ETHYL-BENZENE	m- & p-XYLENE	o-XYLENE	TOTAL VOLATILES[2]
210	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
211	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
212	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
213	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
214	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
215	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
216	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
217	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
218	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
219	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
220	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
221	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
222	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
223	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
224	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
225	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
226	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
227	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
228	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
229	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
230	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

[1]CONCENTRATIONS BASED ON RESPONSE FACTOR OF MTBE

[2]CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS, AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE

TABLE 1 (cont)

LABORATORY RESULTS
FLAME IONIZATION DETECTOR ANALYSIS
CONCENTRATIONS IN MICROGRAMS-PER-LITER

SAMPLE	PENTANE/ MTBE[1]	BENZENE	TOLUENE	ETHYL-BENZENE	m- & p-XYLENE	o-XYLENE	TOTAL VOLATILES[2]
FIELD CONTROL SAMPLES							
21	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
22	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
131	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
132	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
231	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
232	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
LABORATORY SYRINGE BLANKS							
BWF1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BWF2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BWF3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BWF4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BWF5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
DUPLICATE ANALYSES							
20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
20R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
133	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
133R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
210	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
210R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
220	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
220R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
230	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
230R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

[1]CONCENTRATIONS BASED ON RESPONSE FACTOR OF MTBE

[2]CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS, AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE

TABLE 2

LABORATORY RESULTS
ELECTRON CAPTURE DETECTOR ANALYSIS
CONCENTRATIONS IN MICROGRAMS-PER-LITER

SAMPLE	11DCE	t12DCE	11DCA	111TCA	TCE	112TCA	PCE	TECA
1	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
4	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
6	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
7	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
9	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
12	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
14	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
15	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
17	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
20	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
101	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
102	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
104	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
106	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
111	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
113	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
116	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
118	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
120	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
122	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
123	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
125	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
128	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
130	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
201	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
202	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
203	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
204	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
205	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
206	<1.0	<1.0	<1.0	<0.1	1.1	<0.1	<0.05	<0.05
207	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
208	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
209	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
210	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
211	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
212	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05

11DCE = 1,1-dichloroethene **t12DCE = trans-1,2-dichloroethene**
11DCA = 1,1-dichloroethane **111TCA = 1,1,1-trichloroethane**
TCE = 1,1,2-trichloroethene **112TCA = 1,1,2-trichloroethane**
PCE = 1,1,2,2-tetrachloroethene **TECA = 1,1,2,2-tetrachloroethane**

TABLE 2 (cont)

LABORATORY RESULTS
ELECTRON CAPTURE DETECTOR ANALYSIS
CONCENTRATIONS IN MICROGRAMS-PER-LITER

SAMPLE	11DCE	t12DCE	11DCA	111TCA	TCE	112TCA	PCE	TECA
213	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
214	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
215	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
216	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
217	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
218	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
219	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
220	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
221	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
222	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
223	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
224	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
225	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
226	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
227	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
228	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
229	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
230	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05

11DCE = 1,1-dichloroethene **t12DCE = trans-1,2-dichloroethene**
11DCA = 1,1-dichloroethane **111TCA = 1,1,1-trichloroethane**
TCE = 1,1,2-trichloroethene **112TCA = 1,1,2-trichloroethane**
PCE = 1,1,2,2-tetrachloroethene **TECA = 1,1,2,2-tetrachloroethane**

TABLE 2 (cont)

LABORATORY RESULTS
ELECTRON CAPTURE DETECTOR ANALYSIS
CONCENTRATIONS IN MICROGRAMS-PER-LITER

SAMPLE	11DCE	t12DCE	11DCA	111TCA	TCE	112TCA	PCE	TECA
DUPLICATE ANALYSES								
22	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
20R	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
133	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
133R	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
210	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
210R	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
220	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
220R	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
230	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
230R	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
FIELD CONTROL SAMPLES								
21	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
22	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
131	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
132	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
133	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
231	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
232	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
LABORATORY SYRINGE BLANKS								
BWF1	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
BWF2	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
BWF3	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
BWF4	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05
BWF5	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.05	<0.05

11DCE = 1,1-dichloroethene **t12DCE = trans-1,2-dichloroethene**
11DCA = 1,1-dichloroethane **111TCA = 1,1,1-trichloroethane**
TCE = 1,1,2-trichloroethene **112TCA = 1,1,2-trichloroethane**
PCE = 1,1,2,2-tetrachloroethene **TECA = 1,1,2,2-tetrachloroethane**

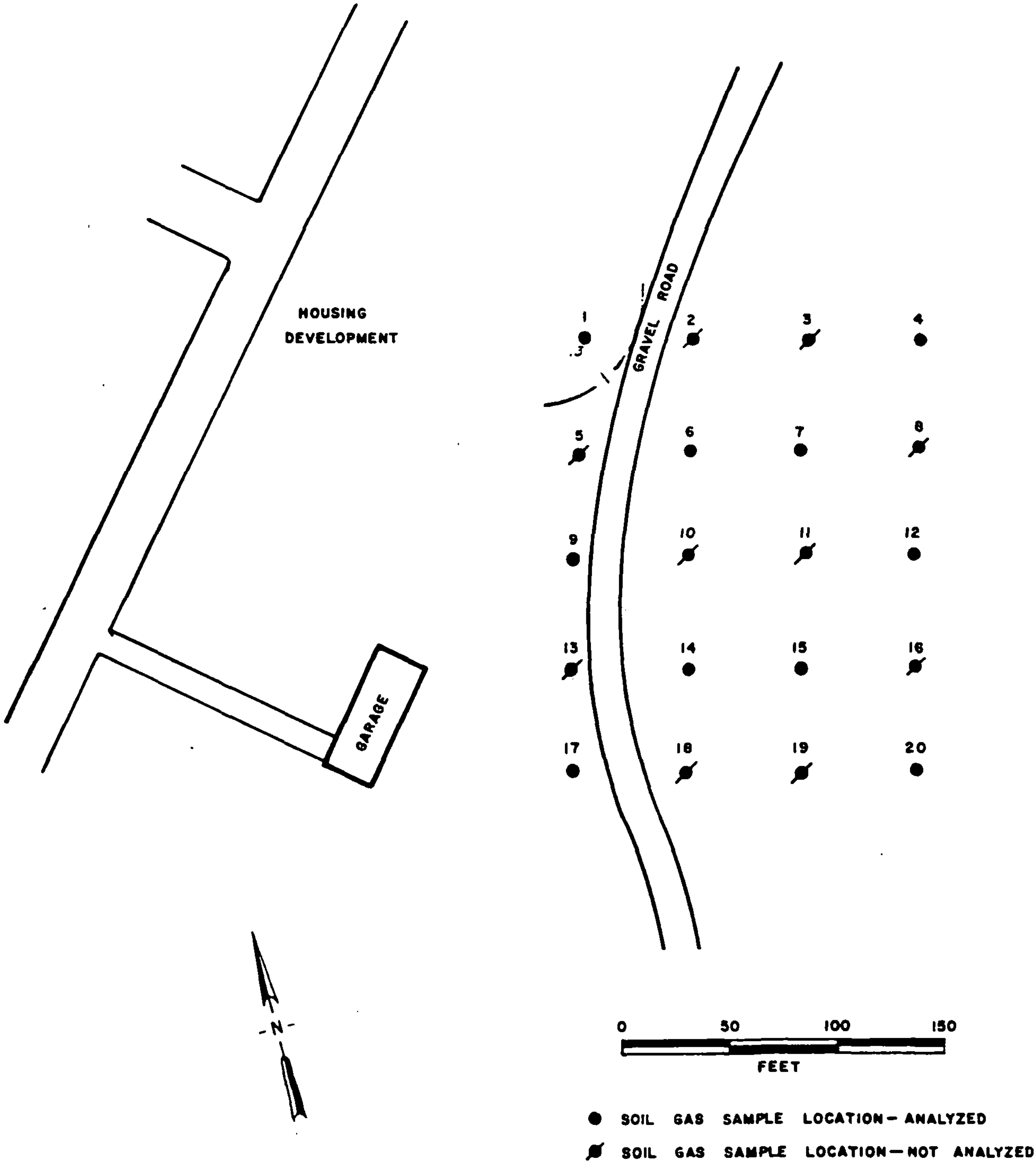


FIGURE 1. FID Total Volatiles (calc'd µg/l)

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

LF-1

SHEPPARD AFB

WICHITA FALLS, TX

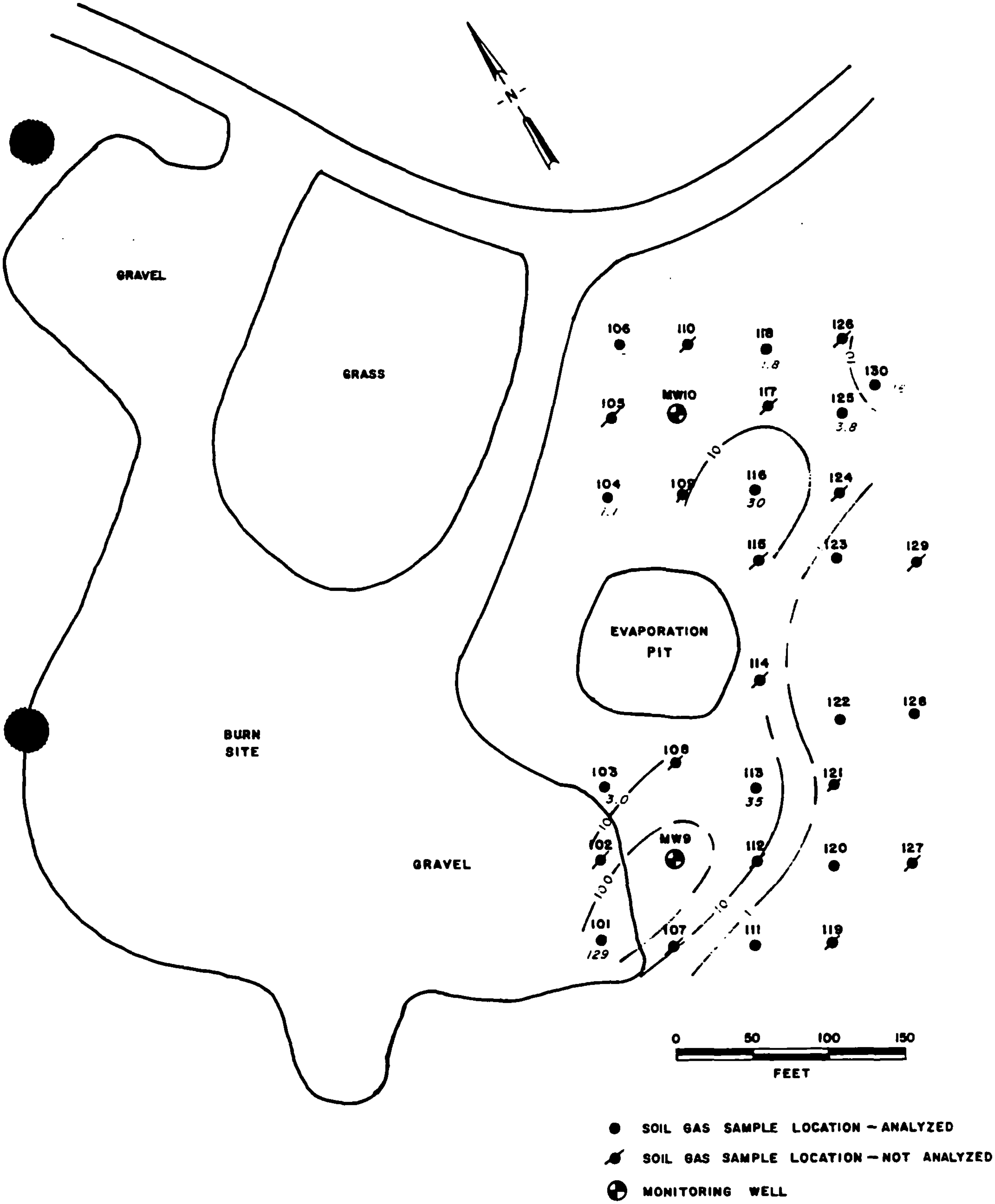


FIGURE 2. FID Total Volatiles (calc'd µg/l)

TARGET ENVIRONMENTAL SERVICES, INC.

FPTA-3

SHEPPARD AFB

WICHITA FALLS, TX

This map is integral to a written report and should be viewed in that context.

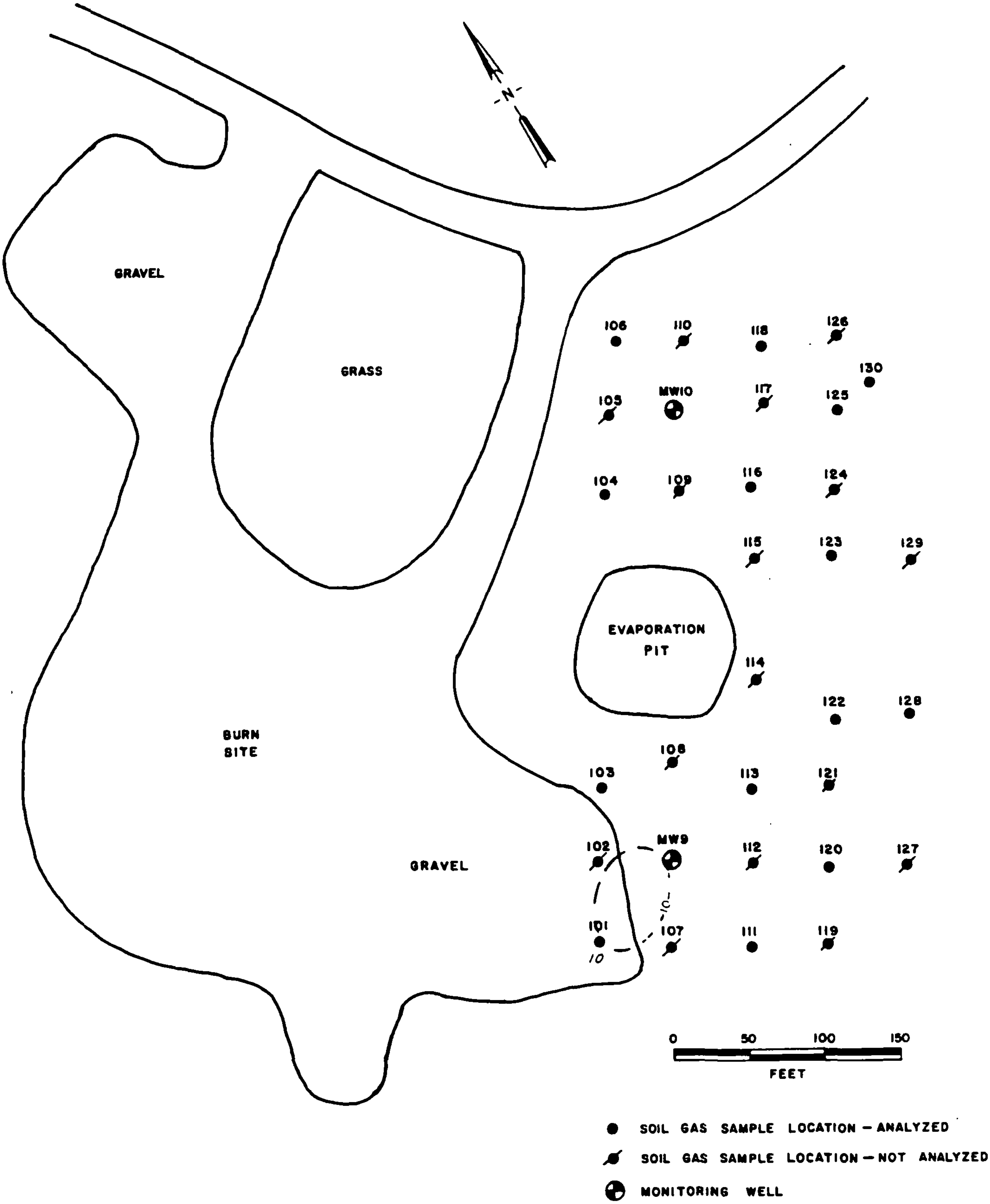


FIGURE 3. MTBE and Pentane (μg/l)

FPTA-3

SHEPPARD AFB

WICHITA FALLS, TX

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

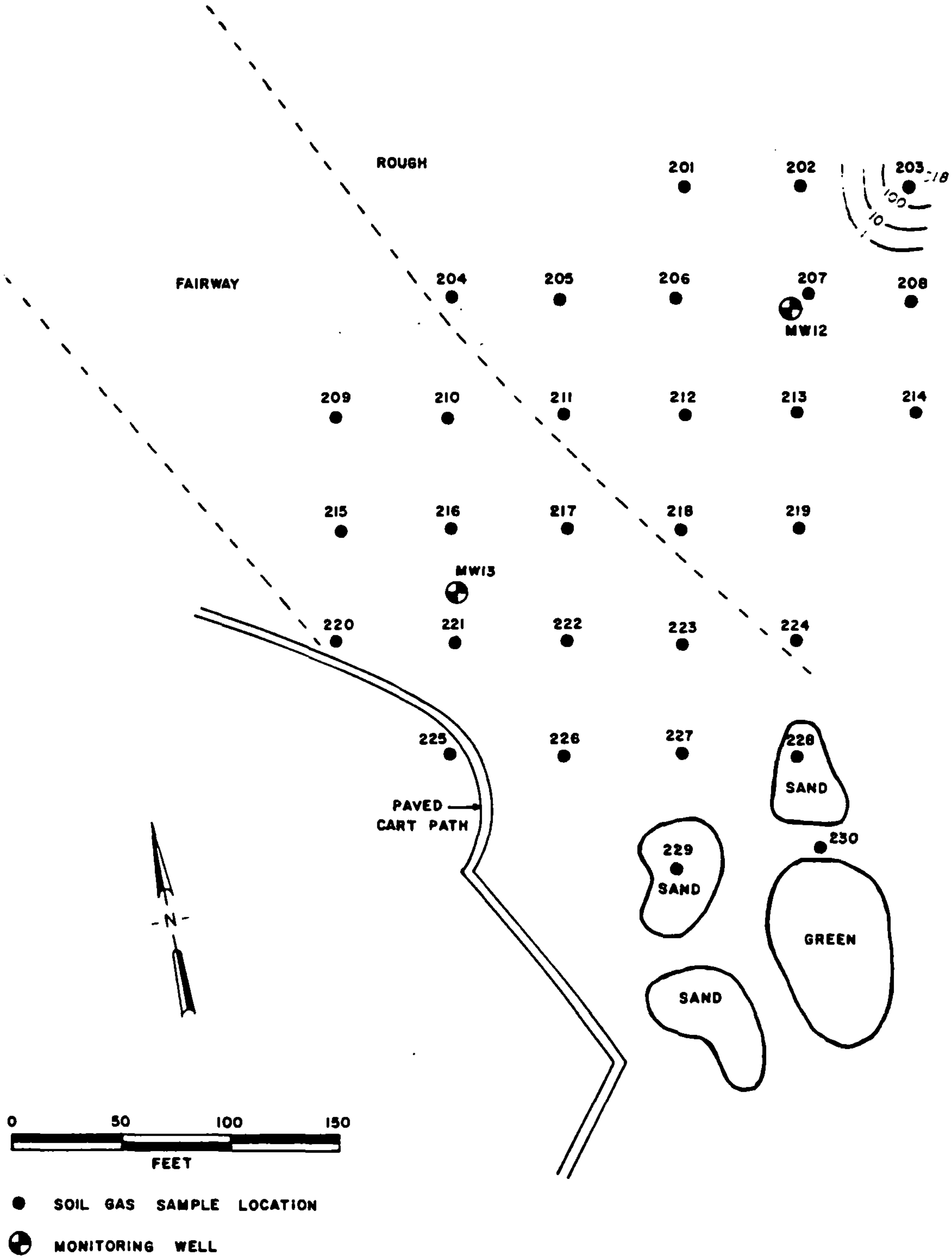


FIGURE 4. FID Total Volatiles (calc'd μg/l)

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

FPTA-1

SHEPPARD AFB

WICHITA FALLS, TX

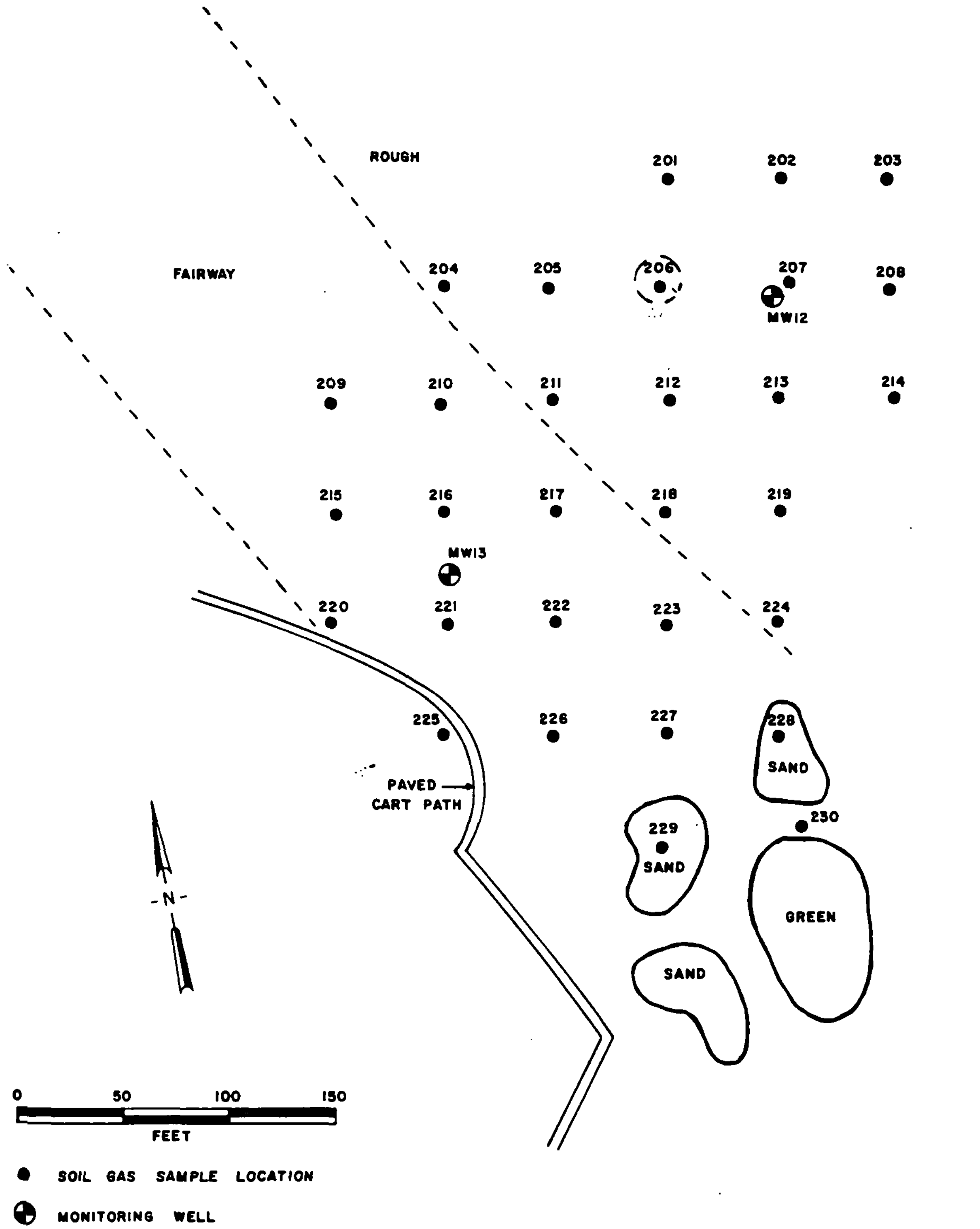


FIGURE 5. TCE (µg/l)

TARGET ENVIRONMENTAL SERVICES, INC.

FPTA-1

SHEPPARD AFB

WICHITA FALLS, TX

This map is integral to a written report and should be viewed in that context.

APPENDIX E

SAMPLE COLLECTION LOGS AND CHAIN-OF-CUSTODY FORMS

SAMPLE COLLECTION LOGS

NUS CORPORATION AND SUBSIDIARIES — **STANDARD CALCULATION SHEET**

CLIENT: HAZWRAP FILE NO.: 7$63 BY: Lewis, Wedekind et al. PAGE 1 OF

SUBJECT: Sheppard AFB, TX - Sample Tracking CHECKED BY: DATE: 11/6/88

SAMPLE NUMBER	DATE COLLECTED	TIME COLLECTED	DATE SHIPPED	TCL Volatile Organics	13 P.P. Metals	P.P. BN/A Extractables	TCL PCBs	TDS	Chloride	Fluoride	Bromide	Nitrate	Phosphate	Sulfate	Cyanide	Gross Alpha Gross Beta	Radium 226	Radium 228	Gamma Spectroscopy	Comments	Entered By	CEC	TCL Pesticides	Organophosphorus Pesticides	Chlorinated Herbicides
$H02-$U-MW201-A	11/08/88	1555	11/09/88	X	X	X	X														JCL	X			
SH02-$U-MW201-A	11/08/88	1555	11/09/88	X	X	X	X													Duplicate	JCL	X			
SH00-TB-NOV08-X	11/08/88	1555	11/09/88	X																	JCL				
$H00-RB-NOV08-X	11/09/88	0900	11/09/88	X	X	X	X														JCL				
$H02-$U-MW202-A	11/09/88	1150	11/09/88	X	X	X	X														JCL				
$H00-RB-NOV09-X	11/09/88	1608	11/14/88 HELD	X	X	X	X													Hold at Lab	JCL				
$H02-$U-MW203-A	11/10/88	1144	11/11/88	X	X	X	X														JCL				
$H00-RB-NOV10-X	11/10/88	1804	11/11/88	X	X	X	X														JCL				
$H06-$U-MW601-A	11/11/88	0910	11/11/88	X	X	X	X														JCL	X			
$H00-TB-NOV11-X	11/11/88	0910	11/11/88	X																	JCL				
$H06-$$-$$601-A	11/11/88	1620	11/11/88	X	X	X	X														JCL				
$H06-$$-$$602-A	11/11/88	1549	11/11/88	X	X	X	X														JCL				
$H06-$$-$$603-A	11/11/88	1527	11/11/88	X	X	X	X														JCL				
$H06-$$-$$604-A	11/11/88	1604	11/11/88	X	X	X	X														JCL				
$H00-RB-NOV12-X	11/12/88	1530	11/14/88	X	X	X	X														JCL				
$H00-TB-NOV12-X	11/12/88	1324	11/14/88	X																	JCL				
$H00-RB-NOV11-X	11/11/88	1400	11/14/88 HELD	X	X	X	X													Hold at Lab	JCL				
$H04-$U-MW401-A	11/12/88	1248	11/14/88	X	X	X	X														JCL				
$H04-$U-MW401-B	11/12/88	1304	11/14/88	X	X	X	X														JCL				
$H04-$U-MW401-C	11/12/88	1324	11/14/88	X	X	X	X														JCL				
$H04-$U-MW402-A	11/12/88	0853	11/14/88	X	X	X	X														JCL	X			
$H04-$U-MW402-B	11/12/88	0912	11/14/88	X	X	X	X														JCL				
$H04-$U-MW402-C	11/12/88	0940	11/14/88	X	X	X	X														JCL				
$H03-$U-MW301-A	11/12/88	1635	11/14/88	X	X	X	X														JCL	X			
$H09-$$-$$901-A	11/13/88	1340	11/14/88																		JCL		X	X	X
$H09-$$-$$901-B	11/13/88	1330	11/14/88																		JCL		X	X	X
$H09-$$-$$902-A	11/13/88	1350	11/14/88																		JCL		X	X	X
$H09-$$-$$902-B	11/13/88	1410	11/14/88																		JCL		X	X	X
$H03-$U-MW302-A	11/13/88	0910	11/14/88	X	X	X	X														JCL				
$H03-$U-MW303-A	11/13/88	1400	11/14/88	X	X	X	X														JCL				
$H00-TB-NOV13-X	11/13/88	1410	11/14/88	X																	JCL				
$H00-TB-NOV13-Y	11/13/88	1800	11/14/88	X																	JCL				
$H00-FB-NOV13-X	11/13/88	1730	11/15/88	X	X	X	X																		
$H00-FB-NOV13-Y	11/13/88	1800	11/15/88	X	X	X	X																		
$H00-RB-NOV13-X	11/13/88	1430	11/14/88	X	X	X	X													Hold at Lab	JCL				
$H00-TB-																									

NUS 1554 REVISED 1085

NUS CORPORATION AND SUBSIDIARIES — **STANDARD CALCULATION SHEET**

CLIENT: FILE NO.: 7063 BY: C. Lyon PAGE 2 OF

SUBJECT: Sheppard AFB – Water Sample Tracking CHECKED BY: DATE: 11/14/88

Sample Number	Sampled Date	Sampled Time	VOAs	13 PP Metals*	PP BNA, PCBs (TCL)	TDS, Anions	CN**	Other Analyses	Comments	Entered By	Shipped
ØH03-GW-MW302A	11/15/88	1335	✓	✓✓✓	✓					CRL	11/15/88
ØH03-GW-MW302X	11/15/88	1335	✓	✓✓✓	✓				Lab dupe.	CRL	"
ØH00-RB-NOV15X	11/15/88	1630	✓	✓	✓					CRL	"
ØH00-TB-NOV15X	11/15/88	1030	✓							CRL	"
ØH03-GW-MW302Z	11/15/88	1335	✓	✓✓✓	✓				Lab splits, hold	CRL	Hold
ØH05-GW-MW011A	11/17/88	0930	✓	✓✓✓	✓	✓	✓✓		in cooler per D.H.	CRL	11/17/88
ØH05-GW-MW013A	11/17/88	0945	✓	✓✓✓	✓	✓	✓✓			CRL	"
ØH03-GW-MW301A	11/17/88	1010	✓	✓✓✓	✓				Extra volume for lab dup. & spikes	CRL	"
ØH00-RB-NOV17X	11/17/88	1050	✓	✓	✓					CRL	"
ØH00-TB-NOV18Y	11/17/88	0900	✓						COC shows one TB w/ incorrect date, TBs	CRL	"
ØH00-TB-NOV17X	11/17/88	0900	✓						~~were~~ in proper cooler	CRL	"
ØH07-GW-MW008A	11/19/88	1300	✓	✓✓✓	✓					CRL	11/21/88 Kept under refrigeration over weekend, unable to use FedEx
ØH07-GW-MW009A	11/19/88	1225	✓	✓✓✓	✓					CRL	
ØH07-GW-MW010A	11/19/88	1240	✓	✓✓✓	✓					CRL	
ØH00-RB-NOV19X	11/19/88	1500	✓	✓	✓	✓	✓		To hold in cooler, lab.	CRL	
ØH00-TB-NOV19X	11/19/88	0830	✓							CRL	
ØH00-TB-NOV19Y	11/19/88	0830	✓							CRL	
ØH00-TB-NOV19Z	11/19/88	0830	✓							CRL	
ØH05-GW-MW012A	11/19/88	1050	✓	✓✓✓	✓	✓				CRL	
ØH05-GW-MW014A	11/19/88	1035	✓	✓✓✓	✓	✓				CRL	
ØH04-GW-MW007A	11/19/88	0910	✓	✓✓✓	✓	✓	✓✓			CRL	
ØH04-GW-MW004A	11/19/88	0925	✓	✓✓✓	✓	✓	✓✓			CRL	
ØH08-ØU-ØBB01A	12/06/88	1045	✓	✓	✓				COLLECTED DUE TO FUEL ODOR	JEW	12/07/88
ØH08-ØU-ØBB01B	12/06/88	1145	✓	✓	✓			CEC		JEW	
ØH08-RB-DEC06X	12/06/88	1645	✓	✓	✓					JW	
ØH07-ØU-ØB701A	12/07/88	0839	✓	✓	✓					JW	
ØH07-ØU-ØB701B	12/07/88	0907	✓	✓	✓			CEC		JW	
ØH07-ØU-ØB701C	12/07/88	1007	✓	✓	✓					JW	
ØH12-ØU-BB01A	12/07/88	1631	✓	✓	✓			GAMMA SCAN, CEC	BASE BACKGROUND	JW	
ØH12-ØU-BB01B	12/07/88	1642	✓	✓	✓			GAMMA SCAN	" "	JW	

NUS 1654 REVISED 1085

*Sampled ✓, Filtered ✓, preserved pH<2 ✓, ** pH>12 ✓, sampled ✓

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: HAZWRAP | FILE NO.: 7963 | BY: DRP | PAGE 3 OF

SUBJECT: Sample Tracking | CHECKED BY: | DATE: 12/8/88

Sample Number	Date Collected	Time Collected	Date Shipped	VOAs	BNAs	PCBs	[illegible]	[illegible]	Metals	Cyanide	TDS	[illegible]	[illegible]	Ra 226	Ra 228	X spec	Other Parameters	Comments	Entered by	Depth of Sample	-REMARKS-
SH03-SE-001-1	12/7	1002	12/7	X	X	X			X										DRP		
SH03-SE-001-1D	12/7	1002	12/7	X	X	X			X									Dup of SH03-SE-001-1	DRP		
SH03-SS-001-1	12/7	1120	12/7	X	X	X			X										DRP		
SH00-RB-DEC6X	12/6	1645	12/7	X	X	X			X									Rinsate Blank	DRP		
SH03-SW-001-1	12/7	0958	12/7	X	X	X			X	X	X	X							DRP		
SH03-SW-001-1D	12/7	0958	12/7	X	X	X			X	X	X	X						Dup of SH03-SW-001-1	DRP		
SH00-RB-DEC7X	12/7	1115	12/7	X	X	X			X									Rinsate blank of SH03-SS-001-1	DRP		
SH00-TB-DEC6X	12/6	0700	12/7	X														Trip Blank	DRP		
SH04-SE-001-1	12/8	1235	12/8	X	X	X			X												
SH04-SE-002-1	12/8	1335	12/8	X	X	X			X												
SH04-SS-001-1	12/8	1315	12/8	X	X	X			X												
SH04-SS-002-1	12/8	1405	12/8	X	X	X			X												
SH02-SS-001-1	12/8	0905	12/8	X	X	X			X												
SH02-SS-002-1	12/8	0940	12/8	X	X	X			X												
SH02-SS-003-1	12/8	1005	12/8	X	X	X			X												
~~SH12-SU-8801A~~																					
SH05-SU-SB501A	12/8	0928	12/8 VOA 12/9 others	X	X	X			X											4'	
SH05-SU-SB501B	12/8	1000	↓	X	X	X			X											14'	
SH05-SU-SB501C	12/8	1045		X	X	X			X											17'	
SH05-SU-SB502A	12/8	1400		X	X	X			X											3'	
SH05-SU-SB502B	12/8	1420		X	X	X			X											18'	
SH00-TB-DEC7X	12/7	0700		X														Trip Blank			
SH04-SW-001-1	12/8	1215	12/8	X	X	X			X	X		X									
SH04-SW-002-1	12/8	1345	12/8	X	X	X			X	X		X									
SH05-SU-SB502C	12/8	1444	12/8 VOA 12/9 others	X	X	X			X											22'	
SH05-SU-MW503A	12/9	0950	12/9	X	X	X			X											2'	
SH05-SU-MW503B	12/9	1002	12/9	X	X	X			X											7'	
SH05-SU-MW503C	12/9	1020	12/9	X	X	X			X											9'	
SH00-RB-DEC8X	12/8	1330	12/9	X	X	X			X									Rinsate Blank			
SH00-TB-DEC9X	12/9	0712	12/9	X														Trip Blank			
SH00-FB-DEC9X	12/9	1350	12/9	X	X	X			X	X	X	X						Field Blank			
SH08-SS-001-1	12/9	1546	12/9	X	X	X			X												
SH07-SU-MW702A	12/9	1538	12/9	X	X	X			X											10'	
SH07-SU-MW702B	12/9	1609	12/9	X	X	X			X											25'	

NUS 155A REVISED 1085

SH07-SU-MW702B	12/9	1620	12/9	X	X	X	X	27'

NUS CORPORATION AND SUBSIDIARIES — **STANDARD CALCULATION SHEET**

CLIENT: HAZWRAP | FILE NO.: 7$63 | BY: PSP | PAGE 4 OF

SUBJECT: SHEPPARD AFB - WATER SAMPLE (Soil) TRACKING | CHECKED BY: | DATE: 12-14-88

Sample Number	Date Collected	Time Collected	Date Shipped	VOAs	BNAs	PCBs	Org Pest	Chlor Pest	Metals	Cyanide	TDS	Common Anions	Gross α/β	Ra 226	Ra 228	X Spec	Other Parameters	Comments	Entered By:	Depth of Sample	- Remarks -
SH11-SU-SB111A	12/11/88	1357	12/12/88	✓	✓	✓			✓							✓			PSP		
SH04-SU-SB403A	12/12/88	0839	12/12/88	✓	✓	✓			✓										PSP	6'	
SH04-SU-SB403B	12/12	0907	12/12	✓	✓	✓			✓										PSP	12'	
SH04-SU-SB403C	12/12	0955	12/12	✓	✓	✓			✓										PSP	17'	
SH04-RB-DEC12X	12/12	1743	12/12	✓	✓	✓			✓									Rinsate Blank	PSP		Trip blank also sent.
$H05-																					

NUS CORPORATION AND SUBSIDIARIES — **STANDARD CALCULATION SHEET**

CLIENT: | FILE NO.: 7763 | BY: C. Lyon | PAGE 5 OF

SUBJECT: Sheppard AFB - Water Sample Tracking | CHECKED BY: | DATE: 12/17/88

Sample Number	Sampled Date	Sampled Time	VOA	13 PP Metals*	PP BN/A, PCBs(TCL)	TDS, Anions	CN**	Other Analyses	Comments	Entered By	Shipped
$H04-GW-MW402A	12/18/88	0930	✓	✓✓✓	✓	✓	✓✓			CRL	
$H04-GW-MW403A	12/18/88	1015	✓	✓✓✓	✓	✓	✓✓		General: All 12/18	CRL	
$H00-TB-DEC18A	12/18/88	0515	✓						samples held	CRL	
$H11-GW-MW11-1A	12/18/88	1100	✓	✓✓✓	✓	✓	✓✓		for Mon. morning	CRL	
$H02-GW-MW301A	12/18/88	1350	✓	✓✓✓	✓	✓	✓✓		FedEx opening	CRL	
$H02-GW-MW302A	12/18/88	1430	✓	✓✓✓	✓				Extra vol for lab dupes	CRL	
$H00-RB-DEC18X	12/18/88	~~1100~~ 1010 CRL 1015	✓	✓	✓	✓	✓		& spikes @ MW-302	CRL	
$H00-TB-DEC18Y	12/18/88	1010	✓							CRL	
$H00-FB-DEC18X	12/18/88	1120	✓	✓	✓	✓	✓	Red. parameters	HPLC cat [illegible]	CRL	
$H00-FB-DEC18Y	12/18/88	1310	✓	✓	✓	✓	✓		Pt. H2O. Trmt. plant	CRL	
$H00-TB-DEC18Z	12/18/88	1410	✓							CRL	
$HBB-GW-MW[illegible]A	12/[illegible]	[illegible]	✓	✓✓✓	✓	✓	✓✓	Red. parameters	Silty. Metal on COC	CRL	
$H00-TB-DEC19Y	12/19/88	0855	✓							PWS	
$H08-GW-MW801A ~~$H08~~ CRL	12/19/88	1015	✓	✓✓✓	✓					CRL	
$H05-GW-MW505A	12/[illegible]	1115	✓	✓✓✓	✓	✓				CRL	
$H05-GW-MW501A	12/19/88	1145	✓	✓✓✓	✓	✓				CRL	
$H05-GW-MW50[illegible]	12/19/88	1220	✓	✓✓✓	✓	✓				CRL	
$H04-GW-MW402B	7/12/89	0920						Gross Alpha Gross Beta		MDB	
* $H11-GW-MW11-1B	7/12/89	0905						Gross Alpha, Gross Beta		MDB	
$H04-GW-MW007B	7/12/89	0850						Gross Alpha, Gross Beta		MDB	
$H03-GW-MW301B	7/12/89	0818						Gross Alpha, Gross Beta		MDB	
$H03-GW-MW3[illegible]B	7/12/89	0826						Gross Alpha, Gross Beta		MDB	
$H03-[illegible]-MW302B	7/12/89	0826						Gross Alpha, Gross Beta		MDB	
$H06-RB-JUL12-X	7/12/89	1055						Gross Alpha, Gross Beta		MDB	
~~$H04-SS209A~~	~~7/[illegible]/89~~	~~1525~~			✓			~~Gross Alpha, Gross Beta~~ TOC MDB		MDB	
~~$H04-SS203A~~	~~7/[illegible]/89~~										
~~$H04-SS200A~~	~~7/[illegible]/89~~										
~~$H04-SS201A~~ MDB	~~7/[illegible]/89~~ MDB										
~~$H04-SS202A~~	~~7/[illegible]/89~~										
~~$H04-SS209A~~	~~7/[illegible]/89~~										
~~$H04-SS210A~~	~~7/[illegible]/89~~										
~~$H04-SS211A~~	~~7/[illegible]/89~~										

NUS 1054 REVISED 1085

* Sampled ✓, Filtered ✓, Preserved ✓ (pH<2)

** Sampled ✓, Preserved ✓ (pH>12)

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: | FILE NO.: 7363 | BY: M. BARTMAN | PAGE 6 OF
SUBJECT: SHEPPARD AIR FORCE BASE | CHECKED BY: Soil Sample | DATE: 7/12/89

SAMPLE NUMBER	SAMPLED DATE	SAMPLED TIME	VOA	13 PP METALS	PP BN/A PEST/PCBS(TCL)	CN	OTHER ANALYSES	COMMENTS	ENTERED BY	SHIPPED
					✓*		TOC		MOB	
$H04#$$204A	7/12/89	1525			✓*				MOB	
$H04#$$205A	7/12/89	1533			✓*				MOB	
$H04#$$206A	7/12/89	1537			✓*				MOB	
$H04#$$207A	7/12/89	1541			✓*				MOB	
$H04#$$208A	7/12/89	1546			✓*				MOB	
$H04#$$209A	7/12/89	1550			✓*				MOB	
$H04#$$210A	7/12/89	1553			✓*				MOB	
$H04#$$211A	7/12/89	1558			✓*				MOB	
$H04#$$212A	7/12/89	1608			✓*				MOB	
$H04#$$213A	7/12/89	1612			✓*				MOB	
$H04#$$214A	7/12/89	1617			✓*				MOB	
$H04#$$215A	7/12/89	1619			✓*			Duplicates	MOB	
$H04#-$$215AD	7/12/89	1619			✓*				MOB	
$H03-$$-$$304A	7/12/89	1743			✓*		TOC		JRH	
$H03-$$-$$305A	7/12/89	1751			✓*				JRH	
$H03-$$-$$306A	7/12/89	1758			✓*				JRN	
$H03-$$-$$307A	7/12/89	1809			✓*				JRH	
$H08-$U-MW802A	7/13/89	1525		✓	✓		CEC, Pet. Hydro	~~Pet. Hydro~~ JRH	JRN.	
$H08-$U-MW802B	7/13/89	1533		✓	✓		Pet. Hydro		JRN	
$H08-$U-MW802C	7/13/89	1648		✓	✓		Pet. Hydro		JRN	
$H08-$U-MW803A	7/14/89	0813		✓	✓		Pet Hydro		JRN	
$H08-$U-MW803B	7/14/89	0821		✓	✓		Pet. Hydro		JRN	
$H08-$U-MW803C	7/14/89	0859		✓	✓		Pet. Hydro		JRH.	
$H02-$U-MW201A	7/13/89	0954		✓	✓*		TOC		JRN.	
$H02-$U-MW201B	7/13/89	1032		✓	✓*		TOC		JRN.	
$H08-$$-$$802A	7/15/89	0838		✓	✓		TOC/CEC		JW	
$H08-$$-$$803A	7/15/89	0844		✓	✓				JW	
$H08-$$-$$804A	7/15/89	0900		✓	✓				JW	
$H08-$E-$E801A	7/15/89	0852		✓	✓				JW	
$H00-RB-JUL15-X	7/15/89	1900		✓	✓			Rinseate	JW	
$H00-RB-JUL16-X	7/16/89	1945	✓	✓				Rinseate ↑	JW	
$H00-TB-JUL17-Z	7/17/89		✓					GT # 885169	JRN	

NUS 1556 REVISED 1085

* submitted for Pesticide analysis only

NUS CORPORATION AND SUBSIDIARIES — **STANDARD CALCULATION SHEET**

CLIENT: SHEPPARD AFB — FILE NO.: 7363 — BY: J. R Hill — PAGE 1 OF 1

SUBJECT: Ground Water Samples Tracking chart — CHECKED BY: — DATE: 7/14/89

Sample Number	Sampled Date	Sampled Time	VOA	13 P.P. Metals	~~P.P. BNA~~ ~~Rot~~ TCL BNA's	Pet. Hydro	Pest.	Other Analyses	Comments	Entered By	Shipping Date
$H05-GW-MW502B	7-14-89	0800	✓	✓	✓	✓	✓			JRH	7-14-89
$H05-GW-MW503B	7-14-89	0830	✓	✓	✓	✓	✓			JRH	7-14-89
$H07-GW-MW701B	7-14-89	0905	✓	✓	✓	✓	✓			JRH	7-14-89
$H00-RB-JUL14 X	7-14-89	1130	✓	✓	✓	✓	✓			JRH	7-14-89
$H00-FB-JUL14 Y	7-14-89	1100	✓	✓	✓	✓	✓			JRH	7-14-89
$H00-TB-JUL14 Z	7-14-89		✓							JRH	7-14-89
$H08-GW-MW801 B	7-17-89	0855	✓	✓	✓	✓	✓			JRH	~~7-14-89~~ JRH 7-17-89
$H03-GW-MW301 C	7-17-89	0945	✓	✓	✓	✓	✓			JRH	~~7-14-89~~ JRH 7-17-89
$H03-GW-MW302C	7-17-89	1020	✓	✓	✓	✓	✓			JRH	~~7-14-89~~ JRH 7-17-89
$H00-TB-JUL17 Z	7-17-89	~~1125~~	✓	~~✓~~	~~✓~~						7-17-89
$H02-GW-MW201 B	7-18-89	~~1500~~ 1425	✓	✓	✓	✓	✓			JW	7/18/89
$H02-GW-MW202 B	7-18-89	~~1500~~ 1500	✓	✓	✓	✓	✓			JW	7/18/89
$H02-GW-MW202BD	7-18-89	1500	✓	✓	✓	✓	✓		Dupe	JW	7/18/89
$H02-GW-MW204A	7-18-89	1605	✓	✓	✓	✓	✓			JW	7/18/89
$H00-RB-JUL18-X	7/18/89	1855	✓	✓	✓	✓	✓		Rinsate	JW	7/18/89
* $H08-GW-MW802A	7/18/89	1830	✓	✓	✓	✓	✓		>24 hrs aft. purging	JW	7/19/89
$H08-GW-MW803A	7/18/89	1856	✓	✓	✓	✓	✓			JW	7/19/89
$H13-GW-MW134A	7/19/89	0743	✓			✓		Lead		JW	7/19/89
$H13-GW-MW133A	7/19/89	0810	✓			✓		Lead		JW	7/19/89
$H13-GW-MW13-1A	7/19/89	0835	✓			✓		Lead		JW	7/19/89
$H13-GW-MW13-2A	7/19/89	0940	✓			✓		Lead		JW	7/19/89
$H04-GW-MW402B	7/19/89	1553	✓	✓	✓	✓	✓			JW	7/19/89
~~$H04-GW-MW~~									Trip Blank	JW	7/19/89
$H00-TB-JUL19Z	7/19/89		✓								
$H00-RB-JUL19X	7/19/89	1801	✓	✓	✓	✓	✓		Not shipped	JW	7/19/89

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[redacted]

CHAIN-OF-CUSTODY FORMS

CHAIN-OF-CUSTODY FORMS

NUS CORPORATION **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63	SITE NAME: Sheppard AFB
SAMPLERS (SIGNATURE): Charles R. Lyon	

~~STATION NO.~~ source	DATE	TIME	COMP.	GRAB	~~STATION LOCATION~~ sample number	NO. OF CON-TAINERS	40 ml. vial	1 gal. glass	1 Lt. plast. w/ HNO_3				REMARKS
MW 302	11/15/88	1335		X	$H03-GW-MW302-A	4	2	1	1				Analyze for TCL Volatile
MW 302	11/15/88	1335		X	$H03-GW-MW302-X	4	2	1	1				Organics, 13 Priority
HPLC	11/15/88	1630			$H00-EB-NOV15-X	4	2	1	1				Pollutant Metals Priority
meta TRACE	11/15/88	1030			$H00-TB-NOV15-X	2	2						Pollutant BN/A Extractibles
													PCBs (TCL)

Note: Sample $H03-GW-MW302-X is a field duplicate.

FED EX TRACKING NO. 9260755663

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
Charles R. Lyon	11/15/88 1900	FEDERAL EXPRESS			
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RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): [signature]

~~STATION~~ source NO.	DATE	TIME	COMP.	GRAB	~~STATION LOCATION~~ sample location	NO. OF CONTAINERS	40 ml. vials	1 gal. glass	1 lt. plastic w/ ...				REMARKS
MW 301	11/17/88	1010		X	$H03-GW-MW301-A	9	4	3	2				Analyze for TCL Volatile Organics, 13 Priority Pollutant Metals, Priority Pollutant BN/A Extractables, PCBs (TCL)
meta TRACE	11/17/88	0900		X	$H00-TB-NOV17-X	2	2						

Note: Extra volume of $H03-GW-MW301-A are provided for lab duplicates and spikes. Some samples are turbid and may require centrifuging.

FED EX TRACKING # 9260755674

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
[signature]	11/17-88 1900	Fed. Express			
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RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

NUS 440 34

NUS CORPORATION | **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 1$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): J.C. Lewis by Charley R. Lon

~~STATION NO.~~ SAMPLE · ~~STATION LOCATION~~ SAMPLE NUMBER

~~STATION NO.~~	DATE	TIME	COMP.	GRAB	~~STATION LOCATION~~	NO. OF CONTAINERS	40 mL. vial	1 gal. glass	1 L. plastic HNO3			
Distiller's water	11/13/88	1130		X	$HOO-FB-NOV13-X	4	2	1	1			
HPLC	11/13/88	1200		X	$HOO-FB-NOV13-Y	4	2	1	1			
meta TENCE	11/15/88	1030		X	$HOO-TB-NOV15-X	2	2					

REMARKS:

Analyze for TCL VOLATILE ORGANICS, 13 Priority Pollutant Metals, Priority Pollutant BN/A Extractables, PCBs (TCL)

~~Note: Please hold~~ MSB
~~sample number~~ MSB

Fed Ex Tracking No. 9260755652

RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):
Charley R. Lon	11/15/88	1900	Fed Express				

RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):

RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:		REMARKS:

NUS CORPORATION **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 1563

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): [signature]

Source ~~STATION~~ ~~NO.~~	DATE	TIME	COMP.	GRAB	Sample Location ~~STATION LOCATION~~ i.d.	NO. OF CONTAINERS	40 ml. vials	1 lit. plastic w/ ...	1 gal. glass	1 lit. plastic	1 lit. plastic w/ ...		REMARKS
MW-11	[illegible]	0930		X	$H05-GW-MW011-A	~~6~~ 6	2	1	1	1	1		
MW-13	[illegible]	0945		X	$H05-GW-MW013-A	~~6~~ 6	2	1	1	1	1		Analyze for TCL Volatile
HPLC	[illegible]	1050		X	$H00-EB-NOV17-X	4	2		1	1			Organics, 13 Priority Pollutant
meta TRACE	[illegible]	0900		X	$H00-TB-NOV18-Y	2	2						Metals, Priority Pollutant BN/A
													Extractables PCB's (TCL),
													Total Dissolved Solids (TDS),
													Chloride, Fluoride, Bromide,
													Nitrate, Phosphate, Sulfate,
													Cyanide.

FED EX TRACKING #9360755[illegible]

RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):
[signature]	11/17-88	1900	FED. EXPRESS				
RELINQUISHED BY (SIGNATURE):	**DATE/TIME:**		**RECEIVED BY (SIGNATURE):**	**RELINQUISHED BY (SIGNATURE):**	**DATE/TIME:**		**RECEIVED BY (SIGNATURE):**
RELINQUISHED BY (SIGNATURE):	**DATE/TIME:**		**RECEIVED FOR LABORATORY BY (SIGNATURE):**	**DATE/TIME:**		**REMARKS:**	

NUS 440 3[illegible]

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.:	SITE NAME:
7Ø63	Sheppard AFB

SAMPLERS (SIGNATURE): Christy R. Lyons

~~STATION NO.~~ Source	DATE	TIME	COMP.	GRAB	~~STATION LOCATION~~ Sample Number	NO. OF CONTAINERS	40ml vial	1 gal. glass	1 lt. plastic w/HNO3	1 lt. plastic	1 lt. plastic w/NaOH		REMARKS
MW-4	11/18/88	0925		X	ØH04-GW-MW004A	6	2	1	1	1	1		Samples with 6 bottles are
MW-7	11/18/88	0910		X	ØH04-GW-MW007A	6	2	1	1	1	1		to be analyzed for TCL Volatile
MW-12	11/19/88	1050		X	ØH05-GW-MW012A	5	2	1	1	1			Organics, 13 PP Metals, PP BN/A
MW-14	11/19/88	1035		X	ØH05-GW-MW014A	5	2	1	1	1			Extractables, PCBs (TCL), TDS
meta-Trace	11/19/88	0830		X	ØH00-TB-NOV19X	2	2						Chloride, Flouride, Bromide, Nitrate,
meta-Trace	11/19/88	0830		X	ØH00-TB-NOV19Y	2	2						Phosphate, Sulfate, & Cyanide.

Trip blank ØH00-TB-NOV19Y was in field with samples from MW-12 and MW-14.
Trip blank ØH00-TB-~~NOVX~~ NOV19X was in field with samples from MW-4 and MW-7.

Samples with 5 bottles are to be analyzed for all the above except Cyanide.

All except metals samples are turbid — may require centrifuging.

Fed Ex Tracking No. 9260755755

RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
Christy R. Lyons	11/21/88	0800	Fed Ex			
RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
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NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63
SITE NAME: Shepperd AFB

SAMPLERS (SIGNATURE): Source [signature] — Sample Number

~~STATION~~ CL ~~NO.~~	DATE	TIME	COMP.	GRAB	~~STATION LOCATION~~ CRL	NO. OF CON-TAINERS	40ml vial	1qt glass	1lt plastic	plastic			REMARKS
MW-8	11/19/	1300		X	$H07-GW-MW008A	4	2	1	1				Analyze for TCL Volatile
MW-9	11/19/	1225		X	$H07-GW-MW009A	4	2	1	1				Organics, 13PP Metals,
MW-10	11/19/	1240		X	$H07-GW-MW010A	4	2	1	1				PP BN/A Extractables,
HPLC	11/19/	1500		X	$H00-RB-NOV19X	6	2	1		3			PCBs (TCL).
meta Trace	11/21/	0830		X	$H00-TB-NOV19Z	2	2						
													Please hold sample
													$H00-RB-NOV19X in
													cooler until further
													notice.

Fed Ex Tracking No. 92607755 155

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
[signature]	11/21/88 0800	Fed Express			
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RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

NUS 440 3

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL Volatile Organics	13 P.P. Metals	P.P. BN/A Extractables	PCBs	CEC		REMARKS
MW201	11/08/88	1555		✓	$H02-$U-MW201-A	6	2	1	1	1	1		8 oz (?) amber glass for 13 P.P. metals (soil)
MW201	11/08/88	1555		✓	$H02-$U-MW201-X	6	2	1	1	1	1		" " P.P. BN/A Es (soil)
TB	11/08/88	1555		✓	$H0Z-TB-NOV08-X	2	2						" " PCBs (soil)
RB	11/08/88	0900		✓	$H00-RB-NOV08-X	4	2	~~1~~ (ONE)		(ONE) ~~1~~			" " CEC (soil)
MW202	11/08/88	1150		✓	$H02-$U-MW202-A	4	2	1	(ONE)				40 ml glass for volatile organics (TCL) (soil)
													1-liter plastic for 13 P.P. Metals (water)
													1-gallon glass for BN/A Es ; PCBs (water)
													40 ml glass for volatile organics (TCL) (water)

Note: The soil samples for metals, BNAEs, and PCBs were split up into separate jars for $H02-$U-MW201-A, whereas for $H02-$U-MW202-A the BNAEs and PCBs sample was put into one jar as per A. Field (11/9/88) JCL

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[signature]	11/9/88	1758	Fed Ex Airbill 9260755534				
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NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): Jonathan C. Lem · J. Kittel · J. W[illegible]

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	TCL Volatile Organics	13 P.P. Metals	P.P. BN/A Extractables	PCB's	CEC		REMARKS
~~MW202~~	~~11/11/88~~	~~1150~~		~~✓~~	~~$H02-$U-MW202-A~~	~~4~~	~~2~~	~~1~~	~~(ONE)~~				8oz(?) amber glass for 13 P.P. Metals (soil)
MW601	11/11/88	0910		✓	$H06-$U-MW601-A	5	2	1	(ONE)	1			8oz(?) amber glass for BNAEs & PCBs (soil)
TB	11/11/88	0910		✓	$H00-TB-NOV11-X	2	2						40 ml glass for volatile organics (soil)
RB	11/10/88	1304		✓	$H00-RB-NOV10-X	4	2	1	(ONE)				40 ml glass for volatile organics (water)
$$601	11/11/88	1620		✓	$H06-$$-$$601-A	4	2	1	(ONE)				1 gal. glass for BNAEs & PCBs (water)
$$602	11/11/88	1549		✓	$H06-$$-$$602-A	4	2	1	(ONE)				1 liter plastic for 13 PP Metals (water)
$$603	11/11/88	1527		✓	$H06-$$-$$603-A	4	2	1	(ONE)				8 oz(?) amber glass for CEC (soil)
$$604	11/11/88	1604		✓	$H06-$$-$$604-A	4	2	1	(ONE)				
MW203	11/10/88	1144		✓	$H02-$U-MW203-A	4	2	1	(ONE)				

JCL

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
Jonathan C. Lem	11/11/88 1800	Fed. Ex. Airbill 9260755545			
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

NUS CORPORATION **CHAIN OF CUSTODY RECORD**

PROJECT NO.:	SITE NAME:
7Ø63	Sheppard AFB

SAMPLERS (SIGNATURE): Jonathan C. Lewis

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL Volatile Organics	13 P.P. Metals	TCL PCBs	P.P. BN/A Extractables	CEC	TCL Pesticides	Organophosphorus Pesticides	Chlorinated Herbicides	REMARKS
MW301	11/11/88	1635		✓	ØH03-ØU-MW301-A	5	2	1	(ONE)		1				40 ml glass for Volatile Organics (water)
ØØ901	11/13/88	1340		✓	ØH09-ØØ-ØØ901-A	2						X	X	X	40 ml glass for volatile Organics (soil)
ØØ901	11/13/88	1330		✓	ØH09-ØØ-ØØ901-B	2						X	X	X	8 oz amber glass for PP metals (soil)
ØØ902	11/13/88	1350		✓	ØH09-ØØ-ØØ902-A	2						X	X	X	8 oz amber glass for PCBs & BNAs
ØØ902	11/13/88	1410		✓	ØH09-ØØ-ØØ902-B	2						x	X	x	(soil)
MW302	11/13/88	0910		✓	ØH03-ØU-MW302-A	4	2	1	(ONE)						8 oz amber glass for CEC (soil)
MW303	11/13/88	1400		✓	ØH03-ØU-MW303-A	4	2	1	(ONE)						2-8 oz Amber glass for TCL Pest.,
TB	11/13/88	1410		✓	ØH00-TB-NOV13-X	2	2								Organophosphorus Pest., and
															Chlorinated Herb. (soil) - for the
															ØØ901 and ØØ902 samples

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
Jonathan C. Lewis	11/14/88 - 1830	Fed Ex Airbill 9260755556			
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NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.:	SITE NAME:
7163	Sheppard AFB

SAMPLERS (SIGNATURE): Jonathan C. [signature]

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL Volatile Organics	13 PP Metals	TCL PCBs	PP BN/A Extractables	TCL Pesticides	Organophosphorous Pesticides	Chlorinated Herbicides	REMARKS
RB	11/09/88	1608		✓	$H00-RB-NOV09-X	4	2	1	(ONE	)				40 ml glass for Volatile Organics (water)
RB	11/11/88	1400		✓	$H00-RB-NOV11-X	4	2	1	(ONE	)				1 liter plastic for PP metals (water)
RB	11/13/88	1430		✓	$H00-RB-NOV13-X	4	2	1	(ONE →	→	→	→	)	1 gallon glass for PCBs & BN/AEs, and
TB	11/13/88	1800		✓	$H00-TB-NOV13-Y	2	2	~~1~~ JCL						for TCL Pest, Organophosphorous Pest,
														and Chlorinated Herb for H00 RB-NOV13-X.

DO NOT RUN ANY OF THESE ANALYSES UNTIL DIRECTED BY NUS CORPORATION TO DO SO. PLEASE HOLD THEM. JC [signature]

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
Jonathan C. [signature]	11/14/88 -1830	Fed Ex Airbill 9260755556			

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NUS 440 34

NUS CORPORATION | **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): Jonathan C. Lin

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCL Volatile Organics	13 PP Metals	TCL PCBs	PP BN/A extractables	CEC	REMARKS
MW401	11/12/88	1248 ~~1444~~ JCL		✓	$H04-$U-MW401-A	4	2	1	(ONE)			8oz amber glass for 13 PP Metals (soil)
MW401	11/12/88	1304		✓	$H04-$U-MW401-B	4	2	1	(ONE)			8oz amber glass for BNAEs & PCBs (soil)
MW401	11/12/88	1324		✓	$H04-$U-MW401-C	4	2	1	(ONE)			40ml glass for volatile organics (soil)
MW402	11/12/88	0853		✓	$H04-$U-MW402-A	5	2	1	(ONE)		1	8oz amber glass for CEC (soil)
MW402	11/12/88	0912		✓	$H04-$U-MW402-B	4	2	1	(ONE)			40ml glass for volatile organics (water)
MW402	11/12/88	0940		✓	$H04-$U-MW402-C	4	2	1	(ONE)			1 liter plastic for 13 pp metals (water)
TB	11/12/88	1324		✓	$H00-TB-NOV12-X	2	2					JCL ~~8oz amber glass~~
RB	11/12/88	1530		✓	$H00-RB-NOV12-X	4	2	1	(ONE)			1 gallon glass for BNAEs & PCBs (water)

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
Jonathan C. Lin	JCL 11/14/88 ~1830	Fed Ex Airbill 9260753556			
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NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.:	SITE NAME:
7363	Sheppard AFB

SAMPLERS (SIGNATURE): David R. Perry

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40 ml VOA	1 l PE metals	1 l PE cyanide	1 l PE TDS	1 l PE *	80 oz BNA	80 oz PCB	REMARKS Waters
	12/6	1645		X	SH00-RB-DEC06X	5	2	1				1		Rinsate Blank BNA + PCB come from 1 80 oz bottle
	12/7	0958		X	SH03-SW-001-1	8	2	1	1	1	1	1	1	
	12/7	0958		X	SH03-SW-001-1D	8	2	1	1	1	1	1	1	
	12/7	1115		X	SH00-RB-DEC7X	5	2	1				1	1	Rinsate Blank of SH03-SS-001-1
DRP	12/7 6	0700		X	SH00-TB-DEC6X	2	2							Trip Blank for Dec 6 + Dec 7

Note: Cyanide preserved with NaOH to pH > 12; Metals w/ HNO_3 to pH < 2

* Chloride, Flouride, Bromide, Nitrate, Phosphate, Sulfate

RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):
David R. Perry	12/7/88	1830	Fed Ex # 926075557				

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						Sent to MetaTrace, Earth City MO

Shipped in 3 coolers

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7863	SITE NAME: Sheppard AFB
SAMPLERS (SIGNATURE): David R Perry	

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40ml VOA	8oz metals	8oz BNA	8oz PCB	8oz CEC		REMARKS: Soils
	12/6	1045		X	SH08-SU-SB801A	4	2	1	1				Depth: 5.0' BNA + PCB are from one 8oz jar
	12/6	1145		X	SH08-SU-SB801B	5	2	1	1		1		Depth: 16' BNA + PCB are from one 8oz jar
	~~12/6~~	~~1645~~		~~X~~	~~SH00-RB-DECO6X~~	DRP 12/7/89							
	12/7	0839		X	SH07-SU-SB701A	4	2	1	1				Depth: 4' BNA + PCB are from one jar
	12/7	0907 ~~1007~~	0907 DRP	X	SH07-SU-SB701B	5	2	1	1		1		Depth: 13' BNA + PCB are from one jar
	12/7	1007		X	SH07-SU-SB701C	4	2	1	1				Depth: 17' BNA + PCB are from one jar
	12/7	1002		X	SH03-SE-001-1	6	2	1	2	1			Sediment
	12/7	1002		X	SH03-SE-001-1D	6	2	1	2	1			Sediment. Dup of SH03-SE-001-1
	12/7	1120		X	SH03-SS-001-1	6	2	1	2	1			Surface Soil
12	12/7	1631		X	SH12-SU-BB01-A	2	2						subsurface soil
12	12/7	1642		X	SH12-SU-BB01-B	2	2						subsurface soil

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(LIP) See 2 of 2

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63

SITE NAME: SHEPPARD AFB

SAMPLERS (SIGNATURE): James Webb

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40 ml VOA	80 oz BNA	80 oz PCB	1 l PE metals	1 l PE cyanide	1 l PE anions	REMARKS Groundwater
	12/7	0700		X	SH00-TB-DEC7X	2	2						Blank (Trip) Dec 7 & Dec 8
	12/8	1215 1217		X	SH04-SW-001-1	7	2	1	1	1	1	1	
	12/8	1345		X	SH04-SW-002-1	7	2	1	1	1	1	1	
	12/8	1444		X	SH05-SU-SB502C	2	2						Soil

Note: Metals preserved with HNO_3 to pH<2; cyanide with NaOH to pH>12

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
James Webb	12/08/88 1840	FEDX #9260755582			
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS: Sent to Metatrace Earth City, MO	

NUS 440 34

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7563

SITE NAME: SHEPPARD AFB

SAMPLERS (SIGNATURE): James A. Wedel...

REMARKS: Soils

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40ml VOA	8oz BNA	8oz PCB	8oz Metals	8oz CEC	8oz b spec	REMARKS
	12/8	1235		X	SH04-SE-001-1	5	2	1	1	1			
	12/8	1335		X	SH04-SE-002-1	5	2	1	1	1			
	12/8	1315		X	SH04-~~SE~~ SS-001-1	5	2	1	1	1			
	12/8	1405		X	SH04-SS-002-1	5	2	1	1	1			
	12/8	0905		X	SH02-SS-001-1	6	2	2	1	1			
	12/8	0940		X	SH02-SS-002-1	5	2	1	1	1			
	12/8	1005		X	SH02-SS-003-1	5	2	1	1	1			
	12/7	1631		X	SH12-SU-BB01A	4		1		1	1	1	Depth: 7' BNA + PCB from one jar VOAs sent 12/7
	12/7	1642		X	SH12-SU-BB01B	4		1	1	1		1	Depth: 17' VOAs sent 12/7
	12/8	0928		X	SH05-SU-SB501A	2	2						4' depth
	12/8	1000		X	SH05-SU-SB501B	2	2						14'
	12/8	1045		X	SH05-SU-SB501C	2	2						17'
	12/8	1400		X	SH05-SU-SB502A	2	2						3'
	12/8	1420		X	SH05-SU-SB502B	2	2						18'

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
James Wedel...	12/8/88 1840	FEDX #9260755582			
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): David R. Perry

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	1l PE TDS common anions	1l PE cyanide	40ml VOA	80z BNA	80z PCB	80z metals	REMARKS
	12/9	1350		X	SH00-FB-DEC9X	2	1	1					Blank-Field sampling event from 12/6 to 12/15
	12/9	1538		X	SH07-SU-MW702A	4			2	1		1	Depth 10'
	12/9	1604		X	SH07-SU-MW702B	4			2	1		1	25'
	12/9	1620		X	SH07-SU-MW702C	4			2	1		1	27'
													Note: water metals preserv/ HNO_3 to pH<2; cyanide preserv/ NaOH to pH>12

RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):
David R. Perry	12/9/88	1830	Fed Ex # 9739022495				
RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:		RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:		REMARKS:	

NUS 440

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7863

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): David R. Perry

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40ml VOA	8oz BNA	8oz PCB	80oz BNA	80oz PCB	1ℓ PE metals	8oz metals	REMARKS	Depth
	12/8	0928		X	SH05-SU-SB501A	3		1	1				1	VOAs sent 12/8	4' (fmt)
	12/8	1000		X	SH05-SU-SB501B	3		1	1				1	VOAs sent 12/8	14'
	12/8	1045		X	SH05-SU-SB501C	3		1	1				1	VOAs sent 12/8	17'
	12/8	1400		X	SH05-SU-SB502A	3		1	1				1	VOAs sent 12/8	3'
	12/8	1420		X	SH05-SU-SB502B	2		1					1	one jar for ~~VOA~~ BNA + PCB; VOAs sent 12/8	18'
	12/8	1444		X	SH05-SU-SB502C	3		1	1				1	VOAs sent 12/8	22'
	12/9	0950		X	SH05-SU-MW503A	4	2	1					1	One jar for BNA + PCBs	2'
	12/9	1002		X	SH05-SU-MW503B	4	2	1					1	One jar for BNA + PCBs	7'
	12/9	1020		X	SH05-SU-MW503C	4	2	1					1	One jar for BNA + PCBs	9'
	12/8	1330		X	SH00-RB-DEC8X	5	2			1	+	1		One bottle for BNA + PCBs; Blank - Rinsate of SH05-SU-SB502A	
	~~12/8~~	~~1330~~	DRP												
	12/9	0712		X	SH00-TB-DEC9X	2	2							Blank - Trip	
	12/9	1350		X	SH00-FB-DEC9X	~~5~~ 4	2			1	+	1		Blank - Field for sampling event beginning 12/8 ending 12/15; BNA + PCB	
	12/9	1546		X	SH0B-SS-001-1	5	2	1	1				1		

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
David R. Perry	1830 12/9	Fed Ex #9234022495			

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:

File 1-1-1

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7863
SITE NAME: SAFB
SAMPLERS (SIGNATURE): Peggy Payne / James Webb

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40 ml VOA's	8 oz amber glass	1 liter plastic	1 liter amber glass			REMARKS
~~301~~ 111 PP	12/11/88	1557		✓	SH11-SU-SB111A	5	2	3					TCL Vol. Org., P.P. Metals, P.P. BNA Extractables, PCB's, CEC, Gamma Spectrometry
403	12/12/88	0839		✓	SH04-SU-SB403A	4	2	2					6' ditto, except Gamma Spec.
403	↓	0907		✓	SH04-SU-SB403B	↓	↓	↓					12' ↓
403	↓	0955		✓	SH04-SU-SB403C	↓	↓	↓					17' ↓
403	↓	1743		✓	SH04-RB-~~RB403~~ DEC12 X (PP)	4	2		1	1			↓

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
James Webb	12/12/88 1833	FED-X #9260755560	FDX #9260755560		
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

NUS 440 3...

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO	SITE NAME
7763	Sheppard AFB

SAMPLERS (SIGNATURE) [signature]

Source ~~STATION NO~~ CRL	DATE	TIME	COMP	GRAB	Sample No. ~~STATION LOCATION~~ CRL	NO OF CONTAINERS	40ml vial	1gal. glass	1gal. Poly	1 lt. w/ HNO3	1 lt. w/ NaOH	1 lt. plastic	REMARKS Analyze For:
HFLC	12/18	1120		✓	$H00-FB-DEC18X	7	2	1	1	1	1	1	TCL Volatile Organics,
Pot. H2O	12/18	1310		✓	$H00-FB-DEC18Y	7	2	1	1	1	1	1	13 PP Metals, TCL BN/A
HFLC	12/18	1315		✓	$H00-RB-DEC18X	7	2	1	1	1	1	1	Extractables, PCBs (TCL),
Trip Blank	12/18	1410		✓	$H00-TB-DEC18Z	2	2						TDS, Chloride, Flouride,
													Bromide, Nitrate, Phosphate,
					Trip Blank								Sulfate, Cyanide, Gross
													Alpha, Gross Beta,
													Radium-226, Radium 228,
													Gamma Spectrometry

Fed Ex Tracking No. 9260755685

RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
[signature]	12/18 0800	Fed Ex			
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS	

NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO: 7163
SITE NAME: Sheppard AFB
SAMPLERS (SIGNATURE): Source [signature] Sample No.

STATION NO.	DATE	TIME	COMP	GRAB	~~STATION LOCATION~~ CRL	NO OF CONTAINERS	40 ml. vial	1 gal. glass	1 lt. poly	1 lt. poly	1 lt. poly	1 gal. poly	REMARKS
MW 403	12/18	1015		✓	$H04-GW-MW403A	6	2	1	1	1	1		Analyze For: TCL Volatile Organics,
MW 402	12/18	0930		✓	$H04-GW-MW402A	6	2	1	1	1	1		13 PP Metals, TCL BN/A
MW 11-1	12/18	1100		✓	$H11-GW-MW11-1A	7	2	1	1	1	1	1	Extractables, PCB's (TCL)
Trip	12/18	0815		✓	$H00-TB-DEC18X	2	2						TDS, Chloride, Bromide,
													Flouride, Nitrate, Phosphate
			Trip Blank										& Cyanide ~~1st 2~~ all samples
													plus Gross Alpha, Gross
													Beta, Radium-226, Radium-228,
													Gamma Spectrometry
													on 3rd sample.

Fed Ex Tracking No. 9260755685

RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
[signature]	12/19/88 0800	Fed Ex			
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS	

NUS 440 34 0484

NUS CORPORATION **CHAIN OF CUSTODY RECORD**

PROJECT NO: 7763

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): Charley R. Lyon

STATION NO	DATE	TIME	COMP	GRAB	~~STATION LOCATION~~ Sample No.	NO OF CONTAINERS	40ml. vial	1gal. glass	1 lt. poly (HNO3)	1 lt. poly w/NaOH	1 lt. poly	1 gal. poly	REMARKS
MW 301	12/1?	1350		✓	+H02-GW-MW301A	6	2	1	1	1	1		Analyze For: TCL Volatile Organics,
MW 302	12/1?	1430		✓	+H02-GW-MW302A	8	4	2	2				13PP Metals, TCP BN/A
MW BB01	12/1?	1000		✓	+HBB-GW-BB01A	7	2	1	1	1	1	1	Extractables, PCBs (TCL)
[illegible] TB	12/1?	1010		✓	+H00-TB-DEC18Y	2	2						Chloride, Bromide, Fluoride,
													Nitrate, Phosphate, Sulfate,
Note: Some samples are turbid													Cyanide, Gross Alpha, Gross
and may require centrifuging.													Beta, Radium 226, Radium
													228, Gamma Spectrometry
													as shown on sample
													labels.

Fed Ex Tracking No. 9260755685

RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
Charley R. Lyon	12/19/? 0910	Fed Ex			
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME	REMARKS	

NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO.: 7863

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): Marilyn L. Brewer / Phillip W. Stidman

Source ~~STATION~~ NO.	DATE	TIME	COMP.	GRAB	Sample NO. ~~STATION LOCATION~~	NO. OF CON-TAINERS	40 ml vial	1 gal. glass	1 lt. plastic w/ HNO_3	1 lt. plastic			REMARKS
MW 801	12/19	1015		X	$H08-GW-MW801A	4	2	1	1				Analyze For:
MW 503	12/19	1115		X	$H05-GW-MW503A	5	2	1	1	1			TCL Volatile Organics,
MW 501	12/19	1145		X	$H05-GW-MW501A	5	2	1	1	1			13 Priority Pollutant
MW 502	12/19	1220		X	$H05-GW-MW502A	5	2	1	1	1			Metals, Priority Pollutant
meta Trace	12/19	0855			$H00-TB-DEC19Y	2	2						BN/A Extractables, PCBs (TCL)
HPLC	12/14	1730		X	$H00-EB-DEC19X	5	2	1	1	1			TDS-Chloride, Bromide,
													Fluoride, Nitrate, Phosphate,
													Sulfate

Note: Some samples are turbid and may require centrifuging. MJB

Please hold sample $H00-RB-DEC19X in cooler until further notice.

FED EX TRACKING NO. # 9260755700

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
Phillip W. Stidman	12/19/88 1900	Fed Ex			
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO: 7$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): [signatures]

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	40 mL vial	1 gal. glass	1 lt. glass	1 lt. plastic w/HNO3	1 lt. plastic w/NaOH	1 lt. plastic	REMARKS
MW 701	12/20	1500		X	$H07-GW-MW701A	4	2	1	1				Analyze for: TCL Volatile Organics,
MW 702	12/20	1530		X	$H07-GW-MW702A	4	2	1	1				13 Priority Pollutant Metals,
Meta Trace	12/20	1415			$H00-TB-DEC20Y	2	2						Priority Pollutant BN/A
HMC	12/20	1430			$H00-RB-DEC20X	6	2	1	1	1	1		Extractables PCBs (TCL)
													TDS, Chloride, Bromide,
													Fluoride, Nitrate, Phosphate
													Sulfate and cyanide.

FED EX TRACKING NO # 926075574

RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
[signature]	12-21-89 [illegible]	Fed Ex.			
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS

NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO: 1Ø63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): [signatures]

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION / SAMPLE NO.	NO OF CONTAINERS	40 ml vial	1 gal. glass	1 lt. plastic	1 lt. plastic w/ HNO3	1 lt. plastic w/ NaOH	1 qt. amber
MW 201	12/10	1250		X	ØH03-GW-MW201A	6	2	1	1	1	1	
MW 202	12/10	1325		X	ØH03-GW-MW202A	6	2	1	1	1	1	
Trip Blank	12/10	1210			ØH00-TB-DEC20X	2	2					
MW-2	12/10	1030		X	†H08-ØØ-ØØC01-A	5	2					3
APLC	12/10	[illegible]			†H00-FB-DEC20X	6	2	1	1	1	1	
(† Lot NO. # XX5169)												

REMARKS

Analyze for: TCL Volatile Organics, 13 Priority Pollutant Metals, Priority Pollutant B/N/A Extractables, PCBs (TCL), TDS - Chloride, Bromide, Fluoride, Nitrate, Phosphate, Sulfate and Cyanide

Note: Some samples are turbid and may require centrifuging. MEB

FED EX TRACKING NO # 9260755744

RELINQUISHED BY (SIGNATURE)	DATE/TIME		RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME		RECEIVED BY (SIGNATURE)
[signature]	12-11-[illegible]	[illegible]	Fed Ex				

RELINQUISHED BY (SIGNATURE)	DATE/TIME		RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME		RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE/TIME		RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME		REMARKS

NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO: 7063
SITE NAME: SHEPPARD AFB
SAMPLERS (SIGNATURE): [signature]

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	PESTICIDES	TOC					REMARKS
00211	7/12/89	1558		✓	0H02-00-00211A	1	1						4oz AMBER GLASS (SOIL)
00212	7/12/89	1608		✓	0H02-00-00212A	1	1						"
00213	7/12/89	1612		✓	0H02-00-00213A	1	1						"
00214	7/12/89	1617		✓	0H02-00-00214A	1	1						"
00215	7/12/89	1619		✓	0H02-00-00215AD	1	1						" DUPLICATE
00215	7/12/89	1619		✓	0H02-00-00215A	1	1						"
00304	7/12/89	1743		✓	0H03-00-00304A	1	1	1					4oz AMBER GLASS (SOIL)
00305	7/12/89	1751		✓	0H03-00-00305A	1	1						"
00306	7/12/89	1758		✓	0H03-00-00306A	1	1						"
00307	7/12/89	1809		✓	0H03-00-00307A	1	1						"

RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE)	DATE/TIME:	RECEIVED BY (SIGNATURE)
[signature]	7/13/89 0800	FED-X #3685204261	FED-X #3685204261		
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS	

NUS 440 34 0484

NUS CORPORATION

CHAIN OF CUSTODY RECORD

PROJECT NO	SITE NAME
7$63	SHEPPARD AFB

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	GROSS ALPHA GROSS BETA	PESTICIDES	TOC				REMARKS
MW301	7/12/89	0818		✓	$H03-GW-MW301B	1	1						1 GALLON PLASTIC JUG (WATER)
MW302	7/12/89	0826		✓	$H03-GW-MW302B	1	1						"
MW302	7/12/89	0826		✓	$H03-GW-MW302BD	1	1						" DUPLICATE
MW007	7/12/89	0850		✓	$H04-GW-MW007B	1	1						"
MW11	7/12/89	0105		✓	$H11-GW-MW11-1B	1	1						"
MW402	7/12/89	0920		✓	$H04-GW-MW402B	1	1						"
RB	7/12/89	1053			$H00-RB-JUL12-X	1	1						"
$$204	7/12/89	1525		✓	$1102-$$-$$204A	1		1	1				4 OZ AMBER GLASS (SOIL)
$$205	7/12/89	1533		✓	$1102-$$-$$205A	1		1					"
$$206	7/12/89	1537		✓	$1102-$$-$$206A	1		1					"
$$207	7/12/89	1541		✓	$1102-$$-$$207A	1		1					"
$$208	7/12/89	1546		✓	$H02-$$-$$208A	1		1					"
$$209	7/12/89	1550		✓	$H02-$$-$$209A	1		1					"
$$210	7/12/89	1553		✓	$1102-$$-$$210A	1		1					

RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE)
[signature]	7/13/89 0800	FED-X # 3685204261	FED-X # 3685204261		
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME	REMARKS	

NUS 440 34 04 84

Grand Water

NUS CORPORATION (2 coolers) **CHAIN OF CUSTODY RECORD**

PROJECT NO	SITE NAME	SAMPLERS (SIGNATURE)
7803	Sheppard AFB	Janice R. Hill

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	VOA	[illegible]	[illegible]	[illegible]	BNA's		REMARKS
MW 502B	7/14	0800		✓	$H05-GW-MW502B	6	2	1	1	1	1		
MW 503B	7/14	0830		✓	$H05-GW-MW503B	6	2	1	1	1	1		
MW 701B	7/14	0905		✓	$H07-GW-MW701B	6	2	1	1	1	1		
RB	7/14	1130		✓	$H00-RB-JUL14X	6	2	1	1	1	1		HPLC 890602 [illegible]
FB	7/14	1100		✓	$H00-FB-JUL14Y	6	2	1	1	1	1		HPLC 890602
TB	7/14			✓	$H00-TB-JUL14Z	2	2						From NUS Lab. Pittsburgh

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Janice R. Hill	1800	7/14/89	Fed-X 3685204250				
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NUS 440 34 0484

— Soil Samples only —
(1 cooler)

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO	SITE NAME
7163	Shepard AFB

SAMPLERS (SIGNATURE): [signature]

	STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	4oz Amber	8oz Amber				REMARKS
	MW 802A	7/13	1525		✓	$H08-$U-MW802A	2	1	1				← Analysis for 13 PP metals,
													BNA's, Pest, Pet Hydro and
													CEC. 12 oz Total
	MW 802B	7/13	1533		✓	$H08-$U-MW802B	2	1	1				
	MW 802C	7/13	1648		✓	$H08-$U-MW802C	2	1	1				Analysis for 13 PP Metals, BNA's,
	MW 803A	7/14	0813		✓	$H08-$U-MW803A	1		1				Pest. and Pet Hydro.
	MW 803B	7/14	0821		✓	$H08-$U-MW803B	1		1				MW802B = 12 oz Total
11.5+	MW 803C	7/14	0859		✓	$H08-$U-MW803C	1		1				MW802C = 12 oz Total
	MW 204A	7/13	954		✓	$H02-$U-MW204A	2	1	1	12 oz			Analysis for 13 PP Metals,
6.5	MW 204B	7/13	1032		✓	$H02-$U-MW204B	2	1	1	12 oz			Pest., TOC. Each sample
													is 12 oz

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[signature]	7-14-88	1800	Fed-X 3685204250			
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NUS 440 34 04 84

13 PP Metals = 13 Priority Pollutant Metals
Pest. = Pesticides
TOC = Total organic carbon

Pet Hydro = Total Petroleum Hydrocarbons
BNA = Base Neutral Acid Extractables

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO: 7863
SITE NAME: SHEPPARD AFB
SAMPLERS (SIGNATURE): [signature]

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	1L Amber	40z Amber	VOA (40ml)				REMARKS
8? -2A	7/15	08??		✓	$HO8-$$-$$802A	1	1					<	Pet... ... TOC CEC
8? -3A	7/15	0844		✓	$HO8-$$-$$803A	1	1						BPPM, BNA's, Pest,
? 4A	7/15	?		✓	$HO8-$$-$$804A	1	1						Pet Hydro...
8 1A	7/15	?		✓	$HO8-$$-$$801A	1	1						
MW 13-1A	7/15	1045		✓	$H13-$$-MW13-1A	2	1	1					Polynuclear Aromatic Hydro,
MW 13-2A	7/15	142?		✓	$H13-$$-MW13-2A	2	1	1					CEC TOC VOA (4oz)
MW 13-2AD	7/15	142?		✓	$H13-$$-MW13-2AD	2	1	1					Purge
MW 13-3A	7/15	1856		✓	$H13-$$-MW13-3A	2	1	1					Polynuclear Aromatic
MW 13-4A	7/16	0125		✓	$H13-$$-MW13-4A	2	1	1					Hydro
RB	7/15	?		✓	$HOO-RB-JUL15-X	1	1					<	BPPM, Pet Hydro BNA's, Pest/PCB
RB	7/16	194?		✓	$HOO-RB-JUL16-X	2	1	1				<	Polynuclear ... (4oz)
TB	7/17	-	-	-	$HOO-TB-JUL17-Z	2	2?		2				Trip BLANK

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[signature]	7/17/85 1850	Fed-X # 3720048603	Fed-X # 3720048603		
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NUS 440 3 04 84

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO: 7663
SITE NAME: Sheppard AFB
SAMPLERS (SIGNATURE): [signature]

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	VOA	Pet. Hydro.	13 P.P. Metals	Pet. T.	BNA's		REMARKS
MW 801B	7/17	0855		✓	$HC8-GW-MW801B	6	2	1	1	1	1		
MW 301C	7/17	0945		✓	$HC3-GW-MW301C	6	2	1	1	1	1		
MW 302C	7/17	1020		✓	$HC3-GW-MW302C	6	2	1	1	1	1		
$HOO	7/17	–	–	–	$HOO-TB-JUL17-2	2	2						TRIP BLANK

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[signature]	7/17/85 / 1850	Fed-X #3720048603	Fed-X #3720048603		

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NUS 440 34 0484

NUS CORPORATION **CHAIN OF CUSTODY RECORD**

PROJECT NO	SITE NAME	NO OF CONTAINERS	VOA	Pet Hydro	[illegible]	[illegible]	Pest	Lead	REMARKS
7863	Sheppard AFB								
SAMPLERS (SIGNATURE)	[signature]								

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	VOA	Pet Hydro	[illegible]	[illegible]	Pest	Lead	REMARKS
MW 802A	7/18	15[illegible]		✓	$H03-GW-MW802A	6	2	1	1	1	1		
MW 803A	7/18	1857		✓	$H03-GW-MW803A	6	2	1	1	1	1		
MW 13-4A	7/18	0745		✓	$H13-GW-MW13-4 A	4	2	1				1	
MW 13-3A	7/17	[illegible]		✓	$H13-GW-MW13-3 A	4	2	1				1	
MW 13-1A	7/19	0855		✓	$H13-GW-MW13-1 A	4	2	1				1	
MW 13-2A	7/11	0740		✓	$H13-GW-MW13-2 A	4	2	1				1	
MW 402B	7/11	1557		✓	$HD4-GW-MW402 B	6	2	1	1	1	1		
T.B.	7/19			✓	$H00-TB-JUL19 Z		2						

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[signature]	7/19/[illegible] 183[illegible]	Fed-X 3[illegible]204305	Fed-X 36[illegible]204305		
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NUS 440 34 0484

NUS CORPORATION — **CHAIN OF CUSTODY RECORD**

PROJECT NO: 7$63

SITE NAME: Sheppard AFB

SAMPLERS (SIGNATURE): [signature]

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	VOA	Pet. Hydro	13 PP Metals	BNA's	Pest.		REMARKS
MW 201B	7/18	1425		✓	$HO2-GW-MW201B	6	2	1	1	1	1		
MW 202B	7/18	1500		✓	$HO2-GW-MW202B	6	2	1	1	1	1		
MW 202BD	7/18	1500		✓	$HO2-GW-MW202BD	6	2	1	1	1	1		Dupe
MW 204A	7/18	1600		✓	$HO2-GW-MW204A	6	2	1	1	1	1		
RB	7/18	~~1645~~ 1655		✓	$HOO-RB-JUL18-X	6	2	1	1	1	1		Rinsate HPLC Lot# 811160
TB	7/18			✓	$HOO-TB-JUL18-Z	2	2						Trip Blank (Fabbricated in lab)

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[signature]	7/18/85 1830	Fed-X 3685204320	Fed-X 3685204320		
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F

APPENDIX F

REQUIREMENTS FOR LABORATORY QUALITY ASSURANCE/QUALITY CONTROL AND DATA VALIDATION

LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

INTERNAL NUS QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS AND PROCEDURES

Introduction

All of the Quality Assurance Requirements (QARs) and Quality Assurance Procedures (QAPs) described in this appendix are based on Issue C of the NUS Quality Assurance (QA) Manual, dated August 4, 1986. The QA Manual presents a formal program designed to monitor and regulate those activities affecting the quality of work performed.

The NUS QA Program is under the supervision of Marty Booska. Objectives of the program are:

- To maintain the evidentiary value for all data generated.
- To ensure the integrity of site investigations, laboratory analyses, and technical reports.
- To control the activities of subcontractors to ensure that they maintain the same quality standards applied to the NUS activities.

Quality Assurance Requirements and Procedures

Table 1 references the QAR and QAP sections applicable to Sheppard AFB. Subsequent sections of this appendix summarize the major QA procedures governing laboratory and field activities.

NUS CORPORATION LABORATORY SERVICES GROUP QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The NUS Laboratory Services Group (LSG) is dedicated to providing services in accordance with quality standards and, thus performs all analyses according to accepted QA practices, quality assurance requirements, and quality control procedures specific to U.S. Air Force HAZWRAP projects. These standards are discussed, in detail, in the LSG draft, "Laboratory Quality Assurance Project Plan for USAF HAZWRAP Sites," currently being developed.

TABLE 1

QUALITY ASSURANCE REQUIREMENTS AND QUALITY ASSURANCE PROCEDURES
APPLICABLE TO SHEPPARD AFB TASKS
SHEPPARD AIR FORCE BASE, WICHITA COUNTY, TEXAS

	QAR 3.0	QAP 3.2	QAP 3.3	QAR 4.0	QAR 7.0	QAP 11.1	QAP 12.1	QAP 13.1	QAP 13.2	QAP 16.1	QAP 17.1	QAP 17.2	QAP 18.1	QAP 19.1
Project Management	●													●
Subcontract Coordination								●	●					
Mobilization/Demobilization								●	●					
Ground Surveying				●	●			●	●					
Geophysical Investigation				●	●									
Drilling Activities				●				●	●					
Geologic/Hydrogeologic Investigation				●	●			●	●					
Health and Safety Oversight				●	●									
Environmental Sampling				●	●						●	●	●	
Laboratory Analysis										●				
Data Validation							●							
Public Health and Environmental Assessment				●										

Wherever CLP protocols will be utilized, the NUS laboratory will adhere to CLP QA/QC procedures. The deliverables will be those called for in the Statement of Work for Inorganic Analysis, Multi-Media; Multi-Concentration SOW Number 787, Revised December 1987; and the Statement of Work for Organics Analysis, Multi-Media, Multi-Concentrations, revised July 1987

Appreciating the importance of their function, the laboratories extend their responsibility beyond conforming to Federal, state, and industrial regulations, codes, and standards to subject all work to technical reviews, before results are released outside the corporation.

The laboratories' QA program is used not only to determine the precision and accuracy of the analytical data, but also to confirm (by documentation) all phases of sample handling, data acquisition and transfer, report preparation, and report review. In addition, it provides for storage and retrieval of both samples and data. Because results may be challenged at any time through legal action and social pressures to abate pollution, retrieval of records and data is essential.

The laboratories' QA program dictates that detailed instructions be available for performing all activities affecting the quality of analytical data. The program provides for appropriate management review and approval of all procedures (including revisions) as well as control of procedures to ensure that laboratory personnel have access to them. The LSG Procedures Manual is structured to address all elements of the LSG's Quality Assurance Program. The basic elements of the LSG QA Program are described in the following paragraphs.

Sample Management, Data Review, and Transfer

A computerized system is used for sample check-in, tracking of samples through the laboratory, assignment of laboratory analyses, and sample check-out. The system provides for management review of all laboratory data before issuance of client reports. The review is accomplished on two levels: review of raw data for each analysis and review of the final results to check for consistency and agreement of the results among all parameters. The computer system offers the advantage of fast retrieval of information.

Each analyst records the analytical results and required calculations on his/her analysis assignment sheet. This sheet is reviewed by the Laboratory Supervisor and/or Group Leader prior to its submittal to the data entry clerk. The review process includes a check of the analyst's calculations on both standards and samples as well as an evaluation of the quality control checks. The analytical results are reviewed again by the Laboratory Supervisor.

All quality control data are reviewed monthly by the QA Coordinator. Unfavorable trends in the data are identified and reported to the Operations Supervisor or Laboratory Manager for appropriate action. The senior laboratory staff meets once each month to discuss QA/QC-related problems or policies.

Program Monitoring

A critical element in LSG's QA Program is program monitoring. Program monitoring, a system for regularly auditing all elements of the QA program, is a responsibility of the LSG's Quality Assurance Coordinator (QAC). Each month, a sufficient number of program elements are reviewed to check for compliance with established procedures. Any deficiencies are reported to management so that corrective actions can be taken. The identified non-conformances are again reviewed by the QAC to ensure that deficiencies have been corrected.

Recordkeeping

Because detailed documentation is needed to support the validity of analytical work, a specific procedure details the requirements for laboratory recordkeeping. The procedure not only describes how to keep records, but also how records are to be identified and stored.

Security

A laboratory security procedure deals with the steps to be taken to maintain the integrity of samples as well as laboratory records. The security system is a way of minimizing the possibility of tampering so that laboratory data can be supported or the analyses recreated, if necessary.

Cleaning and Housekeeping

The nature of laboratory work requires that adequate steps are taken to avoid contamination of samples. Improperly cleaned glassware, equipment, and instrumentation can contribute to unreliable data; therefore, the laboratory has developed specific steps to be followed.

Sample Preservation, Collection, and Storage

The LSG QA Program includes specific procedures for sample preservation, collection, and storage. The procedures are based on the recommendations contained in the appropriate governing publications. Included in the procedures are descriptions of the preservatives to be used, the types of records to be maintained, and the storage requirements.

Analytical Procedures

To ascertain that the laboratory analyses are performed using proper techniques, a section of the LSG Procedures Manual is devoted to laboratory methods. A copy of each laboratory method is centrally located and readily available for the analysts' use. All methods are based on accepted government and industry standards and contain the following information:

- ***Scope***

  A description of the scope or applicability of the procedure.

- ***Principle***

  A brief description of the steps to be taken and/or the theory involved in the laboratory analysis.

- ***Interferences***

  A description of known interfering agents which would cause difficulty in performing the laboratory analysis or would lead to erroneous results.

- ***Apparatus***

  A list or description of equipment required to perform the laboratory analysis.

- ***Reagents***

  A list of the reagents required, a description of the steps involved in preparing the reagents, and instructions on storage requirements and retention times.

- ***Procedure (Instructions)***

  An enumeration of the sequence of activities to be followed. The topics include: sample preparation or pretreatment; sample storage requirements; instrument set-up, standardization or calibration; sample analysis; calculations; and glassware cleaning procedures. The procedure includes any precautions, explanations, or clarifications as needed to properly perform the analysis. These include: safety precautions; the frequency of standardization required; the acceptance criteria or procedures for determining the acceptability of standard curves; clarifications of special techniques critical to the analysis; and how the analyst determines the reliability of sample results based on the standard curves.

- ***Quality Control Requirements***

  A list of the quality control (QC) checks to be performed and the acceptance criteria used to evaluate the QC data.

- ***References***

  A list of the publications from which the information was derived in preparing the laboratory method. As a rule, laboratory methods are derived from the following publications: Standard Methods for the Examination of Water and Wastewater, American Public Health Association; Annual Book of Standards, American Society for Testing and Materials; Methods for Chemical Analysis of Water and Waste, Environmental Protection Agency; Test Methods For Evaluating Solid Waste, SW-846, Environmental Protection Agency (Third Edition, 1986); and Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, Environmental Protection Agency. Editions used are those currently specified in the Federal Register.

Personnel Training

A system has been developed for training within the LSG. The program describes: who is responsible for quality assurance, laboratory skills, analytical methods, and special projects training; the required frequencies for training personnel; and the records to be retained as evidence of training.

Analytical Instruments and Test Equipment

A formal system is used for control of analytical instruments and test equipment used for calibrations. The procedure details the steps to be taken to calibrate and standardize instruments to ensure that analytical data are accurate. All calibrations are traceable to the National Bureau of Standards. This calibration traceability is reported on an Instrument Calibration Record. Calibration frequencies are determined using the guidelines established by the manufacturers. The status of all major laboratory equipment requiring calibration is regularly updated. All inactive equipment is segregated from active equipment and appropriately labeled with an inactive sticker, indicating that the instrument must be recalibrated before use.

Procurement Control

A procurement procedure identifies the methods to be used to document and control the purchase of materials, parts, and services. The procedure includes provisions for identifying the quality of laboratory chemicals and equipment, evidence of management approval of procured items, inspection of shipments for compliance to requirements, and isolation of nonconforming items to be returned to vendors. The quality of all glassware, reagents, and equipment must conform to the requirements specified in the latest edition of the EPA Handbook of Analytical Quality Control in Water and Wastewater Laboratories, the Federal Register, or other regulatory agency publications.

Nonconformance and Corrective Action Control

Incorporated in the LSG's QA Program is a system for identifying, reporting, and correcting nonconformances. A nonconformance is defined as any deficiency which renders the quality of analytical work unacceptable or indeterminable. Deviations from the LSG's QA Program or acceptance criteria are considered nonconformances and require remedial action. The procedure includes provisions for stopping all or a portion of any project until a satisfactory resolution to problems has been achieved.

Quality Control

The quality of analytical data is monitored through the use of quality control procedures. The procedures specify what measures are to be taken to determine the validity of laboratory analyses. These include the analysis of method blanks, reagent blanks, daily standard checks, method duplicates, matrix spikes, and surrogate spikes. Blanks are run, together with the actual samples, to check for possible contamination.

General QC procedures are described on the following pages. QC information specific to the actual analyses proposed for Sheppard AFB can be found in "Quality Control Procedures for Organic Analyses" and "Quality Control Procedures for Inorganic Analyses", which follow this section.

- ***Precision***

Precision refers to the reproducibility of results. At NUS, these results are obtained from actual samples, not from reference standards. The samples selected cover a range of concentrations and a variety of interfering materials.

Every twentieth sample, or one sample in each day's run for a specific parameter, is determined in duplicate using different aliquots, when practical.

The precision of duplicate measurements is expressed as relative percent difference (RPD), which is the absolute value of the range between the duplicate results divided by the mean, expressed as percent. The range or RPD is calculated as follows:

$$\text{Range} = \left| OR - DR \right|$$

$$\text{RPD} = \left| \frac{OR - DR}{1/2(OR + DR)} \right| \times 100\%$$

Where:

OR = original sample result

DR = duplicate sample result

The control limits for precision are set at three times the standard deviation of a series of RPD or range values, calculated as follows:

$$\text{Mean } (\overline{X}) = \frac{1}{n} \sum_{i=1}^{n} Xi$$

$$\text{Standard Deviation (S)} = \sum_{i=1}^{n} (Xi - \overline{X})^2 / (n - 1)$$

Control Limit = 3S

Where:

X = RPD or range values

n = number of x values

- ***Accuracy***

Accuracy is the comparison between observed and known values. Actual samples, if possible those used for precision data, are used for obtaining accuracy data. An aliquot of standard solution is added to the sample. A theoretical result is then calculated and compared to the actual spiked sample.

Accuracy is expressed as matrix spike recovery (MSR) using the following equation:

$$MSR = \frac{AR}{TR} \times 100\%$$

Where:

AR = actual matrix spike result

TR = theoretical matrix spike result

Control limits for accuracy are set at the mean plus or minus three times the standard deviation of a series of MSR values. The mean and standard deviation are calculated as for precision, except that X represents MSR values.

- ***Quality Control Data Monitoring***

The laboratory uses a computerized system for reporting quality control data. The analysts enter the duplicate and spike results into the computer. The computer calculates precision and accuracy and tells the analyst whether the data is in control. Daily generation of quality control data allows the QA staff access to problem data on a timely basis to ensure that corrective action is taken before sample results are reported.

U.S. Air Force Quality Assurance (QA) Requirements

Martin Marietta Energy Systems has proposed standard quality assurance (QA) requirements for all Air Force projects in the "Sampling and Chemical Analysis Quality Assurance Requirements" guide for U.S. Air Force (HAZWRAP) projects, second revision, June 1988. This guide defines three QA levels which are based on the characteristics of the site and the data quality objectives and delivery requirements. A brief description of the intent for each of the three QC levels is as follows:

- Level D: QC to be used when the site, usually near a populated area, is on or soon to be added to the NPL and litigation is likely.
- Level C: QC to be used when the site is near a populated area, but is not on the NPL and litigation is unlikely.
- Level E: QC to be used when the site is in an unpopulated area, is not on the NPL, and litigation is very unlikely. This level is also approprate for waste samples from underground storage tanks.

NUS proposes to follow the proposed guidelines as found in the "Air Force QA/QC Guide" with the following exceptions or clarifications:

- For volatiles and semi-volatiles by gas chromatography/mass spectrometry (GC/MS) and pesticides/PCBs by gas chromatography, Contract Laboratory Program (CLP) methods will be used for all QC levels.
- The use of CLP methods will NOT include qualitative and semi-quantitative analyses from tentatively identified compounds (TICs) by GC/MS for QC Level D volatiles and base-neutral/acids, since the site history indicates only the disposal of specific petroleum-based contaminants (i.e., waste oil, fuel, etc.).
- CLP deliverables for QC Level D will not include data on diskette. Diskette deliverables can be provided at additional charge.
- Sample bottle cleaning procedures will follow the requirements as described in the approved laboratory methods from 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants."

A general summary of the QC and reporting requirements for U.S. Air Force projects is found in Table 2.

QC Level D

U.S. Air Force QA Level D will be used to analyze samples from Sheppard Air Force Base for Target Compound List (TCL) volatiles, base neutral/acid extractables, TCL pesticides/PCBs, organophosphorus pesticides, and chlorinated herbicides. The reference methods that will be used to perform the analyses are summarized on Tables 3 through 6.

The methods for volatiles, base neutral/ acid extractables, and pesticides/PCBs are found in "Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration," July 1987. The reference document for priority pollutant metals is "Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration," SOW 787, July 1987.

Level D analyses will include the QA/QC, chain-of-custody, and delivery requirement (excluding diskette) as described in the CLP Statement of Work (SOW) referenced above.

QC Level C

Some of the analyses that will be performed for Sheppard Air Force Base are not appropriate for Level D QC. These miscellaneous analyses will be performed using QC Level C. A summary for the analyses of the required parameters and the reference methods is found on Tables 3 through 6.

For Level C, NUS will use its routine control limits and acceptance criteria, except for metals, where CLP limits will be used to evaluate precision and accuracy. When sufficient data are available, control limits will be calculated as previously described in the section of the generic QA work plan entitled, "Quality Control (QC)."

QC requirements and acceptance criteria for QC Level C are presented in Table 7. QC delivery requirements for Level C are summarized in Table 8.

FIELD ACTIVITIES QA/QC PLAN

This field activities QA/QC plan provides a mechanism for ensuring that the integrity, reproducibility, and accuracy of field data is maintained.

TABLE 2

QC AND REPORTING REQUIREMENTS
U.S. AIR FORCE

QC Level	Laboratory Methods	QC Checks	Acceptance Criteria	Blanks	Deliverables	Batch Size	Holding Times	Sample Bottle Cleaning(2)
D	CLP (7/87 revision)	CLP	CLP	No subtraction from sample results	CLP (reporting forms modified, where appropriate, when non-TCL parameters are requested)	Per CLP	Per CLP	Per EPA-approved procedures
C	CLP for volatiles, base-neutral and acid extractables, and pesticides/ PCBs. EPA-approved for all others	See Table C-4	See Table C-4	No subtraction from sample results	See Table C-5	Number of samples of similar matrix processed simultaneously through preparation and analysis	Per CLP for TCL, per 40 CFR 136 for all other parameters(1)	Per EPA-approved procedures

(1) These holding times are applied to all sample matrices

(2) Bottle cleaning procedures can be as specified in the laboratory methods, as described in the "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," USEPA.

TABLE 3

REFERENCE METHODS USED FOR PERFORMING ANALYSES
SHEPPARD AIR FORCE BASE, WICHITA COUNTY, TEXAS

Parameter	Reference Method	Air Force QC Level
TCL Volatiles	CLP (without TICs)	D
Priority Pollutant Base Neutral and Acids (with TICs)	CLP (without TICs)	D
TCL Pesticides/PCBs	CLP	D
Priority Pollutant Metals		C
- Antimony	EPA 204.2	
- Arsenic	EPA 206.2	
- Beryllium	EPA 200.7	
- Cadmium	EPA 200.7	
- Chromium	EPA 200.7	
- Copper	EPA 200.7	
- Lead	EPA 239.2	
- Mercury	EPA 245.1, CLP 245.5	
- Nickel	EPA 200.7	
- Selenium	EPA 270.2	
- Silver	EPA 272.1	
- Thallium	EPA 279.2	
- Zinc	EPA 200.7	
- Cyanide	EPA 335.2	

TABLE 3
REFERENCE METHODS USED FOR PERFORMING ANALYSES
SHEPPARD AIR FORCE BASE, WICHITA COUNTY, TEXAS
PAGE 2

Parameter	Reference Method		Air Force QC Level
	Water	Soil/Sediment	
Petroleum Hydrocarbons	EPA 418.1	SW3550(1)/ EPA 418.1	C
Sulfate	SM 426C(2)		C
Phosphate	EPA 365.2		C
Nitrate	EPA 352.1		C
Nitrite	EPA 354.1		C
Fluoride	SM 413B(2)		C
Chloride	SM 407B(2)		C
Bromide	EPA 320.1		C
Total Dissolved Solids	EPA 160.1		C
Cation Exchange Capacity (CEC)		EPA - SW9081	C
Gross Alpha	EPA 900.0	EPA 900.0	C
Gross Beta	EPA 900.0	EPA 900.0	C
Radium-226	EPA 903.0(3)		C
Radium-228	EPA 904.0(3)		C
Gamma Spectrometry	EMSL(4)	EMSL	C

(1) SW refers to "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," SW-846, 3rd Edition.

(2) SM refers to "Standard Methods for the Examination of Water and Wastewater," 15th Edition, APHA-AWWA-WPCF.

(3) EPA (radiochemistry parameters) refers to "Prescribed Procedure for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032.

(4) EMSL refers to "Radiochemical Analytical Procedures for Analysis of Environmental Samples," EMSL-LV-0539-17.

TABLE 4

TARGET COMPOUND LIST (TCL) AND
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) FOR VOLATILES(1)
SHEPPARD AIR FORCE BASE

Volatiles	CAS Number	Quantitation Limits(2)	
		Water ug/L	Low Soil/Sediment(3) ug/Kg
Chloromethane	74-87-3	10	10
Bromomethane	74-83-9	10	10
Vinyl Chloride	75-01-4	10	10
Chloroethane	75-00-3	10	10
Methylene Chloride	75-09-2	5	5
Acetone	67-64-1	10	10
Carbon Disulfide	75-15-0	5	5
1,1-Dichloroethene	75-35-4	5	5
1,1-Dichloroethane	75-34-3	5	5
1,2-Dichloroethene (total)	540-59-0	5	5
Chloroform	67-66-3	5	5
1,2-Dichloroethane	107-06-2	5	5
2-Butanone	78-93-3	10	10
1,1,1-Trichloroethane	71-55-6	5	5
Carbon Tetrachloride	56-23-5	5	5
Vinyl Acetate	108-05-4	10	10
Bromodichloromethane	75-27-4	5	5
1,2-Dichloropropane	78-87-5	5	5
cis-1,3-Dichloropropene	10061-01-5	5	5
Trichloroethene	79-01-6	5	5
Dibromochloromethane	124-48-1	5	5
1,1,2-Trichloroethane	79-00-5	5	5
Benzene	71-43-2	5	5
trans-1,3-Dichloropropene	10061-02-6	5	5
Bromoform	75-25-2	5	5
4-Methyl-2-pentanone	108-10-1	10	10
2-Hexanone	591-78-6	10	10
Tetrachloroethene	127-18-4	5	5
Toluene	108-88-3	5	5
1,1,2,2-Tetrachloroethane	79-34-5	5	5

TABLE 4

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) FOR VOLATILES(1)
SHEPPARD AIR FORCE BASE
PAGE TWO

Volatiles	CAS Number	Quantitation Limits(2)	
		Water ug/L	Low Soil/Sediment(3) ug/Kg
Chlorobenzene	108-90-7	5	5
Ethyl Benzene	100-41-4	5	5
Styrene	100-42-5	5	5
Xylenes (total)	1330-20-7	5	5

(1) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

(2) Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(3) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment (calculated on a dry-weight basis as required by the contract) will be higher.

TABLE 5

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) FOR PESTICIDES/PCBS[1]
SHEPPARD AIR FORCE BASE

Volatiles	CAS Number	Quantitation Limits[2]	
		Water ug/L	Low Soil/Sediment[3] ug/Kg
alpha-BHC	319-84-6	0.05	8.0
beta-BHC	319-85-7	0.05	8.0
delta-BHC	319-86-8	0.05	8.0
gamma-BHC (Lindane)	58-89-9	0.05	8.0
Heptachlor	76-44-6	0.05	8.0
Aldrin	309-00-2	0.05	8.0
Heptachlor epoxide	1024-57-3	0.05	8.0
Endosulfan I	959-98-8	0.05	8.0
Dieldrin	60-57-1	0.10	16.0
4,4'-DDE	72-55-9	0.10	16.0
Endrin	72-20-8	0.10	16.0
Endosulfan II	33013-65-9	0.10	16.0
4,4'-DDD	72-54-8	0.10	16.0
Endosulfan sulfate	1031-07-8	0.10	16.0
4,4'-DDT	50-29-3	0.10	16.0
Methoxychlor	72-43-5	0.5	80.0
Endrin ketone	53494-70-5	0.10	16.0
alpha-Chlordane	5103-71-9	0.5	80.0
gamma-Chlordane	5103-74-2	0.5	80.0
Toxaphene	8001-35-2	1.0	160.0
Aroclor-1016	12674-11-2	0.5	80.0
Aroclor-1221	11104-28-2	0.5	80.0
Aroclor-1232	11141-16-5	0.5	80.0
Aroclor-1242	53469-21-9	0.5	80.0
Aroclor-1248	12672-29-6	0.5	80.0
Aroclor-1254	11097-69-1	1.0	160.0
Aroclor-1260	11096-82-5	1.0	160.0

TABLE 5

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) FOR PESTICIDES/PCBS(1)
SHEPPARD AIR FORCE BASE
PAGE TWO

Notes:

(1) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 15 times the individual Low Soil/Sediment CRQL.

(2) Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

(3) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment (calculated on a dry-weight basis as required by the contract) will be higher.

TABLE 6

PRIORITY POLLUTANT ORGANICS (625/8270)
(GAS CHROMATOGRAPHY/MASS SPECTROSCOPY)
SHEPPARD AIR FORCE BASE

Acid Compounds (625/8270)		Base/Neutral (625/8270)	
1A	2-Chlorophenol	1B	Acenaphthene
2A	2,4-Dichlorophenol	2B	Acenaphthylene
3A	2,4-Dimethylphenol	3B	Antracene
4A	4,6-Dinitro-o-cresol	4B	Benzidine
5A	2,4-Dinitrophenol	5B	Benzo (a) anthracene
6A	2-Nitrophenol	6B	Benzo (a) pyrene
7A	4-Nitrophenol	7B	3,4-Benzofluoroanthene
8A	p-Chloro-m-cresol	8B	Benzo (ghi) perylene
9A	Pentachlorophenol	9B	Benzo (k) fluoranthene
		10B	bis (2-Chloroethoxy) methane
		11B	bis (2-Chloroethyl) ether
		12B	bis (2-Chloroisopropyl) ether
		13B	bis (2-Ethylhexyl) phthalate
		14B	4-Bromophenyl phenyl ether
		15B	Butylbenzyl phthalate
		16B	2-Chloronaphthalene
		17B	4-Chlorophenyl phenyl ether
		18B	Chrysene
		19B	Dibenzo (a,h) anthracene
		20B	1,2-Dichlorobenzene
		21B	1,3-Dichlorobenzene
		22B	1,4-Dichlorobenzene
		23B	3,3'Dichlorobenzidine
		24B	Diethylphthalate
		25B	Dimethyl phthalate
		26B	Di-n-butyl phthalate
		27B	2,4-Dinitrotoluene
		28B	2,6-Dinitrotoluene
		29B	di-n-octyl phthalate
		30B	1,2-Diphenylhydrazine (as axobenzene)
		31B	Fluoroanthene
		32B	Fluorene
		33B	Hexachlorobenzene
		34B	Hexachlorobutadiene
		35B	Hexachlorocyclopentadiene
		36B	Hexachloroethane
		37B	Indeno (1,2,3-cd) pyrene
		38B	Isophorone
		39B	Naphthalene
		40B	Nitrobenzene
		41B	N-nitrosodimethylamine
		42B	N-nitrosodi-n-propylamine

TABLE 7

QUALITY CONTROL REQUIREMENTS FOR QC LEVEL C

Parameters	QC Requirement	Acceptance Criteria
Petroleum hydrocarbons, common anions, and miscellaneous wet chemistry	Matrix spike/matrix spike duplicate - performed prior to sample preparation at a frequency of 1 in 20 samples(1)	Internal control limits
Metals and cyanide	Duplicate and predigestion spike at a frequency of 1 in 20 samples	CLP limits
All parameters	Method blank - 1 per batch	Less than the reporting limit(2)
All parameters	Blank spike - 1 per batch(3)	Internal limits - recovery plotted on control charts
Metals and cyanide	Initial and continuing calibration per CLP protocol	CLP criteria
Common anions, petroleum hydrocarbons, CEC	3-point initial calibration followed by continuing calibration every 12 hours; instrument blank after calibration	Internal limits
Radiologicals	Spiked sample or standards analysis - 1 per batch	Internal limits
Radiologicals, TDS, CEC	Duplicate analysis - 1 in 20 samples	Internal limits RPD

(1) Sample limitations will prevent performing MS/MSD analyses for oil and grease and petroleum hydrocarbons on water samples.

(2) If the samples do not contain the blank contaminants, the samples do not need to be reanalyzed. If the samples and blank contain the analyte in question, the samples from that batch should be reanalyzed. If there is insufficient samples for reanalysis, the data must be flagged.

(3) The blank/spike for water samples is prepared by spiking a standard from a different source than is used for calibration into deionized water. For soil samples, a standard is to be spiked into a control material of similar matrix (obtained from EPA, NBS, or other outside source). The blank/spike for various parameters will consist of the following:

- Pesticides - at least 2 pesticide compounds
- PCBs - at least 1 PCB compound
- Wet chemistry parameters - single spike/method
- ICP analyses - at least 3 metals
- Flame and graphite furnace analyses - all elements analyzed

TABLE 8

DELIVERABLES FOR QC LEVEL C

Method Requirements	Deliverables
LEVEL C - METALS(1)	
Sample results with CLP flags	CLP Form I
Initial and continuing calibration	CLP Form II, Part I only
Post-digestion blank. Frequency of 10 percent	CLP Form III
ICP interference check sample	CLP Form IV
Matrix spike recovery data. One per 20 samples of similar matrix of 1 per sampling event (whichever is more frequent)	CLP Form V, Part I
Post-digestion spike recovery for ICP metals (if pre-digestion spike recovery exceeds CLP limits)	CLP Form V, Part II
Post-digestion spike recoveries for graphite furnace metals	Summary. No specific format
Duplicates (pre-digestion). One per 20 samples of similar matrix or one per sampling event (whichever is more frequent)	CLP Form VI
Method blank spike. One per batch	Control chart (if sufficient data are available) or recoveries
Method of standard addition for graphite furnace metals using the decision process as defined on page E-14 of the CLP protocol	CLP Form VIII
Holding times	CLP Form X
LEVEL C - WET CHEMISTRY(1)	
Method blank spike. One per batch	Control chart (if sufficient data are available) or recoveries
Method blank. One per batch	Report result. No specific format
Sample results	Report results. No specific format
Matrix spike/matrix spike duplicate or calibration data (for petroleum hydrocarbons in water)	Report results. No specific format
Continuing calibration	Report percent RSD or percent difference from initial calibration. No specific format
LEVEL C - RADIOLOGICALS	
Sample results	Report result. No specific format
Method blank. One per batch	Report result. No specific format
Method blank spike. One per batch	Control chart (if sufficient data are available) or recoveries
Duplicate analysis results	Report results. RPD. No specific format
Sample spike or standards analysis	Report results. No specific format

(1) No raw data are required.

Cleaning, Shipping, and Storage of Sample Containers

All containers to be used for sampling are new. Upon receipt from the manufacturer, sample containers to be used for BN/As and pesticides are placed in a muffled oven at 400°C by LSG. Vials to be used for VOA analyses are likewise prepared, at 105°C, by LSG. Following the heat treatment, all containers are sealed and packaged in styrofoam "peanuts." The sample packages will be shipped to Sheppard AFB by common carrier. Upon arrival, the packages will be inspected for damage or tampering. The sample containers will then be stored in the NUS field office and used as needed. Additional cleaning of sample containers will not be required.

Sample Documentation

Proper documentation of each field event is critical. NUS will document all pertinent information, data, observations, problems encountered, and methodologies to provide the following:

- Verification that all applicable QA procedures were followed.
- All the information that would be needed to conduct a complete resampling effort, consistent with prior sampling events.

Various forms of documentation i.e., Sections through will be used to ensure that field data are accurate and retrievable and that sample integrity is maintained.

Sample Labels

Durable labels will be affixed to every sample container to help prevent misidentification of samples. Sample labels will contain the following information:

- Site name.
- Sample number
- Date and time of collection.
- Type of analysis.

Field Logbook

All pertinent information regarding field activities will be entered into a bound logbook(s) with consecutively numbered pages. Entries into the logbook(s) will include the following information:

- Date and time of site entry and exit.
- Personnel on site and their responsibilities.
- Weather conditions.
- Field observations.
- Date, time, depth, location, number, and description of each sample collected.
- Sample collection methodology.
- Sampling Plan changes or deviations.
- Methods of decontamination.
- Health and safety procedures and observations.
- Sample management procedures.
- Maps, sketches, and site descriptions.
- Field measurements such as organic vapor readings, pH, and conductivity.
- Calibration records for field equipment.
- Photography log.

Geologic Data Sheets

Geologic data sheets (i.e., boring logs, well completion logs, and ground-water monitoring well data) will complement the field data contained in the logbook(s). See Figures 1, 2, and 3 for examples of the geologic data sheets to be used.

Chain-of-Custody Record

Sample chain-of-custody will be maintained during all field operations to ensure that unauthorized tampering of samples does not occur. Specific actions taken to ensure that sample chain-of-custody is maintained will be recorded in the field logbook (e.g., locking an unattended vehicle containing samples). In addition, a chain-of-custody record will be generated for each batch of samples shipped

NUS CORPORATION

FIGURE FIELD LOG OF BORING

SHEET ____ OF ____

LOCATION OF BORING:

PROJECT:		BORING NO.
		TOTAL DEPTH:
JOB NO.:	LOGGED BY:	
PROJ. MGR.:	EDITED BY:	
DRILLING CONTRACTOR:		
DRILL RIG TYPE:		
DRILLERS NAME:		
SAMPLING METHODS:		
HAMMER WT:	DROP:	
STARTED, TIME:	DATE:	
COMPLETED, TIME:	DATE:	

BORING DEPTH (ft)			
CASING DEPTH (ft)			
WATER DEPTH (ft)			
TIME:			
DATE:			

BACKFILLED, TIME: DATE: BY:

SURFACE ELEV.: DATUM:

CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	BLOWS/6-IN.	INCHES DRIVEN	INCHES RECOVERED	SAMPLE CONDITION	DRILLING RATE (min/ft)				DEPTH IN FEET	GRAPHIC LOG	
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		

NUS CORPORATION

FIGURE -2

FIELD WELL COMPLETION FORM

JOB NAME:

JOB NUMBER: PROJECT MANAGER:

LOGGED BY: EDITED BY:

WELL NAME: DATE:

DRILLING COMPANY:

EQUIPMENT ☐ ______ INCH HOLLOW STEM AUGER DRILLER:

☐ ______ INCH ROTARY WASH HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING:

DEVELOPMENT

METHOD OF DEVELOPMENT

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ______

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

______ SACKS OF ______ SAND

______ SACKS OF ______ CEMENT

______ GALLONS OF GROUT USED

______ SACKS OF POWDERED BENTONITE

______ POUNDS OF BENTONITE PELLETS

______ FEET OF ____ INCH PVC BLANK CASING

______ FEET OF ____ INCH PVC SLOTTED SCREEN

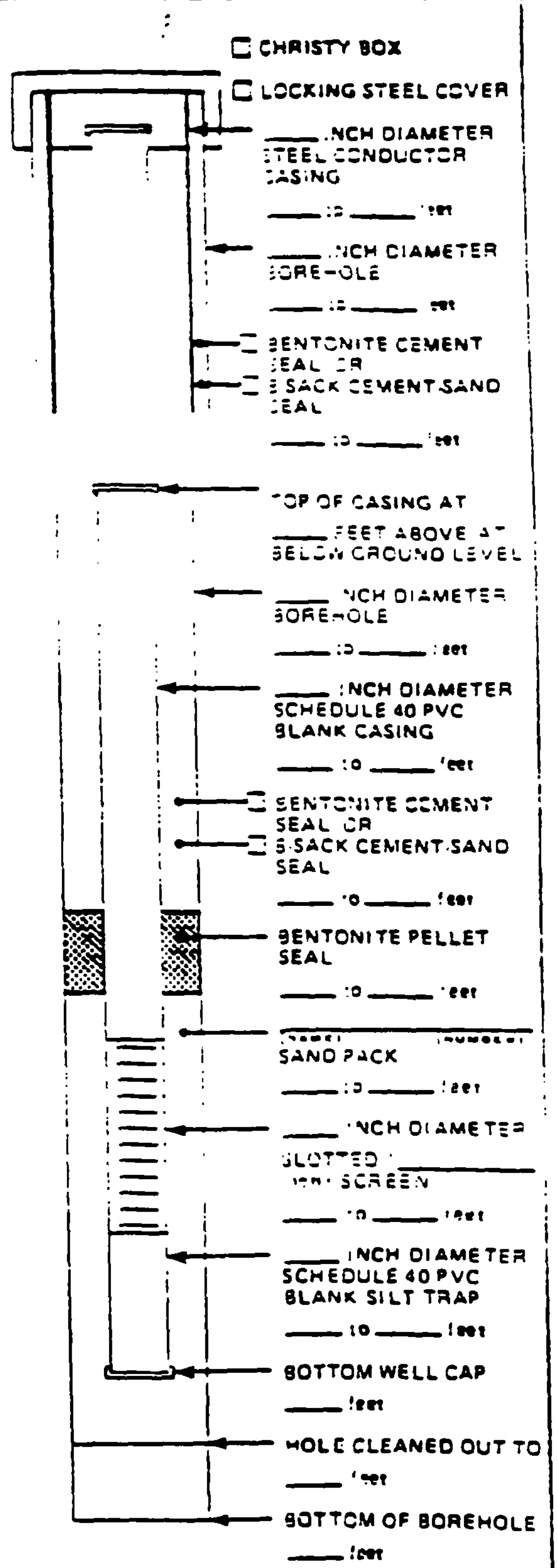
______ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

______ YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☐ NO ☐ YES

NAME ______

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER ______



NOT TO SCALE

ADDITIONAL INFORMATION: ______

FIGURE 3

GROUND-WATER MONITORING DATA SHEET

Monitoring Well No. ______________________________

Stick-Up (feet) ______________________________

Static Water Level From Top of Casing (feet) ______________________________

Total Depth of Well (feet) ______________________________

Height of Water Column ______________________________

Inside Diameter of Well (inches) ______________________________

Well Volume (gallons) ______________________________

PURGING NOTES:

Date _____ Time _____ pH _____ SC _____ Temp. °C _____

Purging Method ______________________________

Estimated Discharge Rate ______________________________

SAMPLE COLLECTION NOTES:

Date Sampled ______________________________

Time ______________________________

within the same cooler. The chain-of-custody record accompanying each shipment of samples will serve to provide documentation for tracking each sample possession. See Figure 4 for an example of the chain-of-custody record to be used. This record will contain the following:

- Site name
- Sample numbers
- Date and time of collection
- Number of containers
- Analysis requested
- Signature of person involved in chain of possession

Custody Seal

Custody seals will be placed on both sides of each shipping cooler lid to ensure that the samples have not been disturbed during transportation. The seals will include the sampler's name and the date.

Sample Packaging and Shipping

Packaging and shipping procedures will be based on the following definitions:

- Low-concentration samples are samples collected in an area surrounding a known spill or dump site. They are considered to contain relatively low pollutant levels.

- High-concentration samples are samples collected directly from waste piles, drums, tanks, chemical spills, or direct discharges in instances where there is little or no evidence of environmental dilution and where the sample is suspected to contain greater than 15 percent of any individual chemical contaminant.

The following shipping procedures comply with Department of Transportation (DOT) regulations (49 CFR Section 171-179).

FIGURE 4

NUS CORPORATION *CHAIN OF CUSTODY RECORD*

PROJECT NO					SITE NAME	NO OF CONTAINERS								REMARKS
SAMPLERS (SIGNATURE)														
STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION									

RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS	

All low-concentration samples should be packaged and shipped as follows:

1. Place each sample container in a 2-mil plastic bag and seal the bag.

2. Place the container in a DOT-approved cooler.

3. Fill the cooler one quarter full of packing material (e.g., vermiculite or perlite).

4. Fill several plastic bags with ice chips, seal the bags, and pack the ice bags around the samples.

5. Fill the cooler with packing material.

6. Place all paperwork going to the laboratory (i.e., chain-of-custody record) inside a plastic bag and tape it to the inside of the cooler lid.

7. Close the cooler, seal it with strapping tape, and place at least one custody seal over the front edge of the cooler and one over the back edge.

8. Deliver the cooler to Federal Express (or other express carrier) using a standard airbill.

All high-concentration samples should be packaged and shipped as follows:

1. Leave at least 10 percent head space for sample jars, and ensure that the jars are <u>not</u> kept in an environment exceeding 130°F. If head space will affect sample integrity, place the full sample container inside a larger container so that the latter is filled to a maximum of 90 percent of its capacity.

2. Place each sample container in a plastic bag at least 2 mil thick and seal the bag.

3. Place each container in a separate paint can, and fill the can with packing material.

4. Place the lid on each paint can; seal with metal clips or tape.

5. Place arrows on the cans indicating which end should be up.

6. Write the proper shipping name and identification number on each can. Note: When the nature of the sample is uncertain, it should be designated as either flammable liquid or flammable solid. For flammable liquids, the proper shipping name is Flammable Liquid, Not Otherwise Specified (N.O.S.), and the Identification Number is UN1993. For flammable solids, the proper shipping name is Flammable Solid, N.O.S., and the Identification Number is UN1325. Proper shipping names of specific substances can be found in the DOT hazardous materials table (49 CFR Part 172.101).

7. Place the cans upright in a DOT-approved cooler and fill the cooler with packing material. If space permits, the cans can be stacked one on top of another.

8. Place all paperwork going to the lab (i.e., chain-of-custody record) inside a plastic bag and tape it to the inside of the cooler lid.

9. Close the cooler, seal it with strapping tape, and place at least one custody seal over the front edge of the cooler and one over the back edge.

10. Write the proper shipping name and identification number on the top and all four sides of the cooler.

11. Place a "This End Up/Inside Packages Comply with Prescribed Regulations" label on the top and all four sides of the cooler, with upward pointing arrows on the sides of the cooler.

12. Place "Danger" and either "Flammable Liquid" or "Flammable Solid" labels on the top and all four sides of the cooler.

13. Write the addressee and addressor on the top of the cooler.

14. "Cargo Aircraft Only" labels must be used if the net quantity of sample in each outer container is greater than one quart (for "Flammable Liquid, N.O.S.") or 25 pounds (for "Flammable Solid, N.O.S.").

15. High-hazard airbills should be used for shipping. The "Shipper Certification for Restricted Articles" section should be filled out as follows:

- Number of packages - number of coolers
- Proper shipping name
    - Flammable Solid, N.O.S.
    - Flammable Liquid, N.O.S.
- Classification
    - Flammable Solid
    - Flammable Liquid
- Identification number (respectively)
    - UN1325
    - UN1993
- Net quantity per package - number of containers per cooler.
- Radioactive materials section - leave blank.
- Passenger/cargo aircraft - up to 25 pounds of flammable solid per cooler can be shipped on a passenger aircraft. Up to 1 quart of flammable liquid per cooler can be shipped on a passenger aircraft and up to 10 gallons of flammable liquid per cooler can be shipped on a cargo aircraft.
- Print your name and title.
- Give an emergency telephone number where you can be reached within the next 24-48 hours.
- Sign the airbill.

16. Deliver the cooler, along with its high-hazard airbill, to Federal Express (or other express carrier).

Table 9 presents methods of sample preservation, sample containers, and holding times to be employed.

QA/QC Samples

Four types of QA/QC samples will be collected as part of this project:

- Splits and Duplicates - Not more than 5 percent of all samples will be tested in duplicate as part of an NUS internal laboratory QA/QC check. The Sheppard AFB Environmental Coordinator will select which samples will be taken as splits.

- Trip Blanks - Trip blanks will be collected to check for cross-contamination between samples during shipping. Each bottle will be filled with deionized water, transported to the site, handled in the same manner as a sample, and returned to the laboratory for analysis. One set of trip blanks will be shipped in each cooler containing VOAs. Trip blanks will be analyzed for all applicable VOAs.

- Rinsate Blanks - Rinsate blanks are used to check the effectiveness of cleaning procedures used on sampling equipment. Rinsate blanks will be collected from selected pieces of sampling equipment. After the equipment is cleaned, deionized water will be poured through or over it. The rinsate will then be collected in appropriate containers. One rinsate blank will be collected per day. The sampling equipment to be used for the collection process will vary daily. Only those samples collected every other day will be shipped for laboratory analysis. The remaining samples will be held until a determination can be made as to whether or not a potential equipment-cleaning problem exists. Rinsate blanks will be analyzed for all applicable organics and metals.

- Field Blanks - Field blanks will be used to check for cross-contamination resulting from water used for decontamination. Each bottle will be filled with deionized water on site by the sampler and shipped to a laboratory for analysis. One set of field blanks will be prepared for each source of decontamination water used per sampling trip. Field blanks will be analyzed for all applicable organics and metals.

TABLE 9

WATER SAMPLES
METHODS OF PRESERVATION, SAMPLE CONTAINERS, AND HOLDING TIMES
SHEPPARD AIR FORCE BASE, WICHITA COUNTY, TEXAS

MATRIX: WATER

Parameter	Preservation	Sample Container	Sample Container Size	Holding Time
Volatile Organics, TCL (no TICs)	Cool, 4°C	G Teflon-lined septum	2-40 ml	10 days
Antimony	HNO_3 to pH < 2	P or G	1 Liter	6 months
Beryllium				
Cadmium				
Chromium				
Copper				
Nickel				
Silver				
Thallium				
Zinc				
Arsenic				
Lead				
Selenium				
Mercury				28 days
[illegible]nide	NAOH to pH > 12 Cool, 4°C Add 0.6g ascorbic acid if residual chlorine present	P or G	1 Liter	14 days
Priority Pollutant Base Neutral/Acids (no TICs)	Cool, 4°C	G Teflon-lined cap	80 Ounce	Extraction - within 5 days; Analysis - within 40 days after extraction
PCBs/Pesticides, TCL	Cool, 4°C	G Teflon-lined cap	80 Ounce	Extraction - within 5 days; Analysis - within 40 days after extraction
Bromide	Cool, 4°C	P or G	1 Liter	28 days
Chloride	Cool, 4°C	P or G	1 Liter	28 days
Fluoride	Cool, 4°C	P	1 Liter	28 days
Nitrate	Cool, 4°C	P or G	1 Liter	48 hours
Phosphate	Cool, 4°C	P or G	1 Liter	28 days
Sulfate	Cool, 4°C	P or G	1 Liter	28 days
Total Dissolved Solids	Cool, 4°C	P or G	1 Liter	7 days
Gross Alpha, Gross Beta	HNO_3 to pH < 2	G	1 Liter	6 months
Radium-228*	HNO_3 to pH < 2	G	1 Liter	6 months
Radium-226*	HNO_3 to pH < 2	G	1 Liter	6 months
[illegible]mma Spectrometry	HNO_3 to pH < 2	G	1 Liter	6 months

TABLE 9
METHODS OF PRESERVATION, SAMPLE CONTAINERS, AND HOLDING TIMES
SHEPPARD AIR FORCE BASE, WICHITA COUNTY, TEXAS
PAGE TWO

MATRIX: SOIL

Parameter	Preservation	Sample Container	Sample Container Size	Holding Time
Volatile Organics, TCL (no TICs)	Cool, 4°C	G Teflon-lined septum	2-4 Ounce	10 days
Antimony Beryllium Cadmium Chromium Copper Nickel Silver Thallium Zinc Arsenic Lead Selenium Mercury	Cool, 4°C	P or G	8 Ounce	6 months 6 months 6 months 6 months 6 months 6 months 6 months 6 months 6 months 6 months 6 months 6 months 28 days
Priority Pollutant Base Neutral/Acids (no TICs)	Cool, 4°C	G Teflon-lined cap	2-8 Ounce	Extraction - within 10 days; Analysis - within 40 days after extraction
Organophosphorus Pesticides	Cool, 4°C	G Teflon-lined cap	8 Ounce	Extraction - within 7 days; Analysis - within 30 days after extraction
PCBs/Pesticides, TCL	Cool, 4°C	G Teflon-lined cap	8 Ounce	Extraction - within 10 days; Analysis - within 30 days after extraction
Chlorinated Herbicides	Cool, 4°C	G Teflon-lined cap	8 Ounce	Extraction - within 10 days; Analysis - within 30 days after extraction
Cation Exchange Capacity	Cool, 4°C	G	4 Ounce	Unspecified
Gamma Spectrometry		G	4 Ounce	6 months

* Analysis for the isotope of radium will be performed only if gross alpha and/or gross beta exceed background levels.

P = Polyethylene
G = Glass

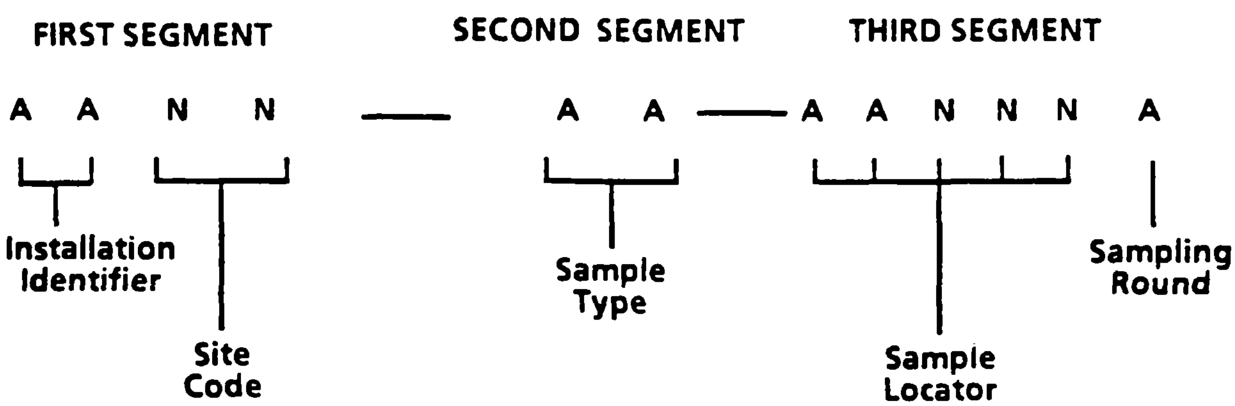
References:

"Test Methods; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA Document 600/4-82-057, Environmental Monitoring and Support Branch, Cincinnati, Ohio, 1982.
"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Document SW846, Third Edition, Revised USEPA 1986.
"Methods of Soil Analysis, Part II, Chemical and Microbiological Properties," Second Edition, 1982.

Sample Numbering System

Each sample collected will be assigned a unique sample number. The sample number will consist of a three-segment alphanumeric code which identifies the installation, the site, the sample type, the sample collection location, and the sampling round.

The alphanumeric coding to be employed in the sample numbering system is explained in the following diagram and the subsequent definitions:



Character Type:

A = Alpha
N = Numeric

Installation Identifier:

SH = Sheppard Air Force Base

Site Code: See Table C-10

Sample Type: These include, but are not limited to, the following:

SW = Surface Water
GW = Ground Water
SS = Surface Soil
SU = Subsurface Soil

SE = Sediment

FB = Field Blank

TB = Trip Blank

RB = Rinsate Blank

Sample Locator:

Sample locators will indicate precisely where each sample was collected (e.g., MW-101 would indicate that the sample was collected from monitoring well number 101).

Sampling Round:

Sampling events (or rounds) will be in alphabetical sequence beginning with "A."

TABLE F-1

SAMPLE NUMBERING SYSTEM SITE CODES
SHEPPARD AIR FORCE BASE
WICHITA COUNTY, TEXAS

Site Description	Acronyms	Site Code
Waste Pit - 1	WP09	01
Landfill - 2	LF04	02
Landfill - 1	LF05	03
Landfill - 3	LF06	04
Fire Protection Training Area - 1	FT01	05
Fire Protection Training Area - 2	FT02	06
Fire Protection Training Area - 3	FT03	07
Industrial Waste Pit	WP10	08
Pesticide Spray Area	OT11	09
Low-Level Radioactive Waste Disposal Site - 1	RW07	10
Low-Level Radioactive Waste Disposal - 2	RW08	11

DATA VALIDATION

ORGANICS

Listed below are the validation criteria which will be utilized in evaluating the analytical data developed for the nine sites at Shepard AFB.

PETROLEUM HYDROCARBONS (EPA 418.1, SW3540, EPA METHOD 418.1)*

HOLDING TIMES

Holding times are undefined if the samples are preserved and refrigerated.

CALIBRATION

Make certain that a five-point curve is completed daily.

BLANKS

Make certain that a blank is run daily.

TCL VOAs EPA-CLP METHODOLOGIES

Validation procedures will be in accordance with: "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses," May 1985 (except qualitative and semi-quantitative analyses for TICs).

PRIORITY POLLUTANT BNAs EPA-CLP METHODOLOGIES

Validation procedures will be in accordance with: "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses," May 1985 (except qualitative and semi-quantitative analyses for TICs).

---

* EPA 100, 200, 300, and 400 series refer to Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March, 1983.
"SW" refers to Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846, Third Edition, November, 1986.
EPA 600 series refers to Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057, July, 1982.

TCL PESTICIDES/PCBs, ORGANOPHOSPHORUS PESTICIDES AND CHLORINATED HERBICIDES – EPA-CLP METHODOLOGIES

Validation procedures will be in accordance with: "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses," May 1985.

INORGANICS

PRIORITY POLLUTANT METALS (EPA-CLP METHODOLOGIES)

Validation procedures will be in accordance with: "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses," May 1985.

COMMON ANIONS

Anion	Method Reference
Cyanide (CN^-)	EPA 335.2
Sulfate ($SO_4^{=}$)	SM426C
Phosphate (PO_4^{-3})	EPA 365.2
Nitrate (NO_3^-)	EPA 352.1
Fluoride (F^-)	SM* 413 B
Chloride (Cl^-)	SM 407 B
Bromide (Br^-)	EPA 320.1

CYANIDE, SULFATE, PHOSPHATE

HOLDING TIMES

Cyanide - 14 days
Sulfate - Unspecified
Phosphate - None, if preserved

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* SM refers to Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WPCF, 16th Edition, 1985.

If the above holding times are not met, all corresponding data will be considered estimates (J).

CALIBRATION

Check to verify if a daily standard was run and compared to a previous calibration curve. This must meet internal QC criteria.

DUPLICATES AND MATRIX SPIKE

Duplicates and a matrix spike must be analyzed 1 in 20 per matrix per Air Force Base.

The resulting data should meet internal QC criteria.

NITRATE

HOLDING TIME

The holding time for nitrate is 14 days. If this is not met, all corresponding data will be considered estimates (J).

CALIBRATION

A five-point calibration curve should be prepared each day sample analyses are performed.

DUPLICATES AND MATRIX SPIKE

Duplicates and a matrix spike must be analyzed 1 in 20 per matrix per Air Force Base.

FLUORIDE (SOLUBLE)

HOLDING TIME

No holding time is indicated in the method.

CALIBRATION

A three-point calibration curve should be prepared each day sample analyses are performed.

DUPLICATES AND MATRIX SPIKE

Duplicates and a matrix spike must be analyzed 1 in 20 per matrix per Air Force Base.

CHLORIDE

HOLDING TIME

No holding time is indicated in the method.

CALIBRATION

Standardization of the titrant must be done monthly.

DUPLICATES AND MATRIX SPIKE

Duplicates and a matrix spike must be analyzed 1 in 20 per matrix per Air Force Base.

BROMIDE

HOLDING TIMES

Samples must be analyzed as soon as possible.

CALIBRATION

Standardization of the sodium thiosulfate titrant must be done daily.

DUPLICATES AND MATRIX SPIKE

Duplicates and a matrix spike must be analyzed 1 in 20 per matrix per Air Force Base.

TOTAL DISSOLVED SOLIDS

HOLDING TIME

The holding time for total dissolved solids is 7 days. If this is not met, all corresponding data will be considered estimates (J).

DUPLICATES

Duplicates must be analyzed in 20 per matrix per Air Force Base.

CATION EXCHANGE CAPACITY

HOLDING TIMES

Samples must be analyzed as soon as possible.

CALIBRATION

Standard of known cation exchange capacity must meet internal QC limits.

BLANKS

Verify that contamination and memory effects are not occurring.

RADIOLOGICALS

DUPLICATES

Duplicate must be analyzed 1 per sample batch.

BLANKS

Verify that contamination and memory effects are not occurring.

SPIKE SAMPLE OR STANDARD REFERENCE CHECK

Ensure equipment is calibrated and operating properly.

VALIDATION LETTERS

NUS CORPORATION

INTERNAL CORRESPONDENCE
C-34-4-9-87

TO: DOUG HODSON

DATE: APRIL 14, 1989

FROM: HAIA ROFFMAN HKR

COPIES: RICH CAMBOTTI
KEITH STANG

SUBJECT: DATA VALIDATION - SHEPPARD AFB
METAL ANALYSES OF THIRTY SEVEN
WATER AND SOIL SAMPLES
METATRACE INC. LABORATORY

MetaTrace Inc. analyzed 37 water and soil samples from the Sheppard AFB for metals. The data were evaluated based on the following parameters.

- data completeness
- laboratory blank analysis
- matrix spikes
- laboratory duplicates
- detection limits
- calibration verification
- ICP interference checks
- field duplicates
- field blank

The data package was eventually complete. Results are summarized in the attached Table A. Attached are also the supporting summaries of QA/QC forms provided by the laboratory.

The initial and continuing instrument calibrations met requirements, and the ICP interference check also met requirements. The samples were generally analyzed within acceptable holding times except for several mercury analyses for which the holding time was slightly exceeded. The reagent water blank was free of contamination.

Samples SHOOFB-NOV13X and SHOOFBNOV13Y were field blanks and samples SHOORB-NOV17X, SHOORB-NOV15X, SHOORB-NOV18X and SHOORB-NOV12X were rinsate blanks. The two field blanks contained very similar concentrations of copper (10 µg/l in each), mercury (0.6 µg/l in each), silver (4 and 12 µg/l) and zinc (13 and 10 µg/l). The rinsate blanks from November 15, 17 and 18 contained the same metals at very similar concentrations while the rinsate from November 12th contained 29 µg/l of cadmium, 23 µg/l of chromium, 30 µg/l of copper, 11 µg/l of silver and 1761 µg/l of zinc. Samples collected on November 12th contained two orders of magnitude lower levels of zinc and cadmium levels in samples collected during this date were below the detection limit. Thus, the data reported for the November 12th rinsate blank are not being used in this review.

Based on the considered field and rinsate blank results, the detection limit of copper should be raised to 50 µg/l, of mercury should be raised to 3 µg/l, of silver should be raised to 36 µg/l and of zinc should be raised to 50 µg/l. Action is taken in Table A.

Matrix spike recoveries conducted on two water samples and two soil samples were all within the acceptable range of 75 to 125 percent, except for antimony which ranged between 17 and 46 percent, cadmium which ranged from 128 to 136 percent, lead which was 185 percent in one soil spike and chromium which was 140 percent in one soil spike. Based on these data all antimony values should be rejected (R'd), all cadmium values should be approximated (J'd) and considered on the high side. Lead and chromium values in the soil samles should be approximated and considered on the high side. Action is taken in Table A.

The laboratory duplicate analyses resulted in Relative Percent Difference (RPDs) which were in the acceptable range, except for lead in sample SH36WMW302A (the value for the sample was 108 µg/l and for the duplicate less than 2 µg/l) and for sample SH036GWMW301A (the value for the sample was 124 µg/l and for the duplicate less than 2 µg/l). The reported lead value for the field duplicate to sample SH03GWMW302A (sample SH03GWMW302X) was less than the detection limit. Based on these data the lead values for the laboratory duplicate analyses should be rejected (R'd). Action is taken in Table A.

Samples SH03GWMW302A and SH03GW302X and SH0SUMW201A and SH02SOMW201X were two sets of field uplicate analyses. For the first set of field duplicate samples the results are in very good agreement, except for lead for which action has been taken. For the second set of duplicate samples the agreement between metal results is good, except for lead (12.6 µg/l and 6.2 µg/l which corresponds to an unacceptable RPD value of 68.1 percent). Thus, all lead values should be approximated.

HKR/lmd
Attachments

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-4-9-147

TO: DOUGLAS HODSON

DATE: APRIL 24, 1989

FROM: S. CHARLES CARUSO *SCC*

COPIES: RICH CAMBOTTI
HAIA ROFFMAN
KEITH STANG

SUBJECT: VOC DATA VALIDATION OF SAMPLES FROM SHEPPARD AIR FORCE BASE, IA PROJECT 182-02

Data for fifty-two (52) samples, consisting of eighteen (18) soils and thirty-four (34) water samples, analyzed by MetaTrace, Inc. for volatile organic compounds were reviewed. The data evaluation was based on the following criteria:

- Data completeness
- Holding times
- GC/MS tuning and performance
- Surrogate spike recovery
- Control matrix spike recovery
- Laboratory and field blank analyses
- Detection limits
- Initial and continuing calibration
- Duplicate sample analysis

The data was complete as submitted with the exception of data for one method blank (VBLKC 333), which was missing.

Contract Requirements

Contract requirements were met for surrogate spike recoveries, GC/MS tuning and performance criteria, blank analysis, matrix spike/matrix spike duplicate recoveries, and detection limits. The GC and spectral identifications were satisfactory. Some deficiencies were found and these are summarized below.

- Methylene chloride and acetone were present in the blanks; therefore, the positive results of these compounds reported in associated samples at concentrations below 10 times the blank concentration have been qualified with a "U".

- Due to a low instrument response factor (RF < 0.05) for 2-butanone, the reported detection limits for this analyte in associated samples are considered unusable and qualified with a "R".

- The % Relative Standard Deviation (%RSD) during initial calibration exceeded 50% for vinyl acetate, 4-methyl-2-pentanone, and 2-hexanone; therefore, the quantitation limits for the non-detects in associated samples were qualified as estimated, "UJ".

- Due to the Percent Difference between initial and continuing calibration exceeding the 25% limit for methylene chloride and acetone, the positive results for these compounds in associated samples are considered as estimated and flagged with a "J".

- The Percent Difference between initial and continuing calibration was very high (%D > 50) for chloromethane, bromomethane, chloroethane, carbon disulfide, carbon tetrachloride, vinyl acetate, 4-methyl-2-pentanone, and 2-hexanone. Consequently, the detection limits of these analytes in associated samples are considered as estimated and flagged with a "UJ".

- The Holding Times were exceeded for three soil samples (AA21850, AA21851, and AA21852); therefore, positive results for acetone and the quantitation limits for the non-detects in these samples are considered as estimated and qualified "J" and "UJ", respectively.

- The reported results for chloroform in some samples are considered as estimated, since they are below the Contract Required Detection Limits (CRDL), and quantitation below the CRDL are not 99 percent confident. These values are flagged with a "J".

In addition, some miscellaneous format problems were found and these are listed below:

- The area counts for two of the three internal standards for samples SH06-SS-SS604-A (AA21851) were below the lower limit and they were not flagged with an asterisk by the laboratory. However, no action was required, since the holding time for this sample exceeded the limit and the data had been qualified on this basis.

- Some of the % Relative Abundance Data reported on Form 5A were rounded off incorrectly.

- The % Relative Abundance for ion $^{m}/e$ 75 on Form 5A for the BFB injection on 11/16/88 was missing.

- The data for one of the method blanks (VBLKC 333) for the sample set analyzed on 11/28/88 was missing. However, the positive results were qualified on the basis of the contaminants reported in the QA blanks (rinsate and trip blanks).

- The Standards Data were reported on the wrong forms.

If you have any questions or require additional information, please contact me.

SCC/lmd

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-4-9-153

TO: DOUGLAS HODSON

FROM: MATTHEW D. BARTMAN MDB

SUBJECT: SHEPPARD AIR FORCE BASE ORGANIC VALIDATION

DATE: APRIL 24, 1989

COPIES: RICH CAMBOTTI
HAIA ROFFMAN
KEITH STANG

NUS Laboratory Services Division analyzed a total of 99 samples which consisted of 55 soil, 29 water and 15 associated blanks for PCBs. The data were reviewed according to "EPA Functional Guidelines for Organic Data Validation" as prescribed by the Hazardous Waste Remedial Action Program's (HAZWRAP) "Requirements for Quality Control of Analytical Data". These analyses were performed under HAZWRAP Level D QC requirements and data validation was based on the following criteria:

- Data completeness
- Holding times
- Matrix spike/duplicate results
- Laboratory and field blank analyses
- Initial and continuing calibration

The data package was complete as submitted and sample results are summarized in the attached Table A. Areas of concern are discussed below.

Minor Problems

Dibutylchlorendate (DBC) was not added to samples during extraction. Consequently, shifts in retention times nor surrogate recoveries could be determined. However, in the evaluation of PCB analysis, pattern recognition is of greater significance than single peak retention time. Due to matrix spike recoveries being of acceptable criteria and surrogate recoveries being an advisory item all data is acceptable as is.

MDB/lmd
Attachments

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-4-9-154

TO:	DOUGLAS HODSON	DATE:	APRIL 24, 1989
FROM:	MATTHEW D. BARTMAN MDB	COPIES:	RICH CAMBOTTI HAIA ROFFMAN KEITH STANG
SUBJECT:	SHEPPARD AIR FORCE BASE ORGANIC DATA VALIDATION		

NUS Laboratory Services Division analyzed a total of 73 samples which consisted of 19 water, 35 soil and 19 associated blanks from Sheppard Air Force Base for volatile analysis. The data were reviewed according to "EPA Functional Guidelines for Evaluating Organic Data Validation" as prescribed by the Hazardous Waste Remedial Action Program's (HAZWRAP) "Requirements for Quality Control of Analytical Data". These analyses were performed under HAZWRAP Level D QC requirements and data validation was based on the following criteria:

- Data completeness
- Holding times
- GC/MS tuning and mass calibration
- Surrogate spike recovery
- Matrix spike/duplicate results
- Laboratory and field blank analysis
- Initial and continuing calibration

The data package was complete as submitted and sample results are summarized in the attached Table A. GC/MS tuning and mass calibration, surrogate spike recoveries, matrix spike/matrix spike duplicate analysis and detection limits met contract required criteria.

Laboratory and field blank (rinsate and trip blanks) analysis indicated various levels of acetone, methylene chloride, toluene, chloroform and 4-methyl-2-pentanone. Consequently, detection limits for positive samples have been elevated and sample results should be considered non-detect due to uncertainity of where contamination is introduced.

Identification of compounds and quality control data are acceptable. Sample results are accepted as qualified.

MDB/lmd
Attachments

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-4-9-156

TO: DOUGLAS HODSON

DATE: APRIL 25, 1989

FROM: HAIA K. ROFFMAN HKR

COPIES: RICH CAMBOTTI
KEITH STANG

SUBJECT: DATA VALIDATION - SHEPPARD AFB
MISCELLANEOUS ANALYSES OF THIRTY
SIX WATER AND SOIL SAMPLES
METATRACE, INC. LABORATORY

Metatrace, Inc. analyzed twenty-five water samples for the following parameters, chloride, fluoride, bromide, nitrate, nitrite, sulfate, o-phosphate, total phosphate, cyanide and total dissolved solids (TDS) and eleven soil samples for cation exchange capacity (CEC). The data were reviewed and evaluated based on the following QA/QC parameters:

- Data completeness
- Holding times
- Laboratory blank analysis
- Field blanks
- Field duplicates

The data package was eventually complete. Results are summarized in the attached Table A.

The samples were generally analyzed within acceptable holding times. The laboratory reagent blank did not contain any of the analyzed parameters at concentrations which exceeded the laboratory required detection limit. Thus, no action is needed.

On December 18th and December 20 the field personnel submitted two rinsate blanks for analyses. The rinsate blank from December 18 was free of the analyzed parameters and the rinsate blank from December 20th contained 8 mg/l of TDS. Thus, the detection limit of TDS for samples collected on December 20 should be raised to 40 mg/l. Review of the data provided in Table A indicates that all TDS values for this date were above the 40 mg/l. Thus, no action can be taken.

On December 18, 1988, a field blank was submitted for analysis. This field blank sample was free of contamination, except for 15 mg/l of TDS. Thus, the detection limit of TDS should be raised to 75 mg/l for samples collected on December 18, 1988. Review of the data provided in Table A indicates that all TDS values for samples collected during that date are above 75 mg/l. Thus, no action can be taken.

The field blank for December 20, 1988 was free of contamination. No action is needed.

Samples 03-SW-001-1 and 03-SW-001-1D were field duplicates for water samples. Results reported for these two samples were very close, except for cyanide (80.3 and 17.5 mg/l respectively). Cyanide was detected only in these two samples and in sample 04-GW-MW-403A (6.63 mg/l). Based on these two duplicate analyses, all cyanide values should be approximated. Action is taken in Table A.

Samples SH02-SU-MW-201A and SH02-SU-MW-201X were two soil duplicate samples. The CEC values obtained for these two soil samples (7.6 and 5.4 mez/100 g) are in good agreement for soil samples. Thus, no action is needed.

HKR/lmd
Attachments

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-4-9-162

TO: DOUGLAS HODSON

FROM: RICHARD E. TARBERT REF

SUBJECT: SHEPPARD AIR FORCE BASE
BNA ORGANIC DATA VALIDATION

DATE: APRIL 26, 1989

COPIES: RICH CAMBOTTI
HAIA ROFFMAN
KEITH STANG

This data set contained the results of 77 BNA fraction organic analyses. It consisted of 36 water analyses and 41 soil analyses. The water analyses included six rinsate blanks, four field blanks, and eight repeat analyses. The soil analyses included six repeat analyses. There was one field duplicate pair submitted for each matrix. The data validation was based on the following criteria:

- Holding times
- Instrument performance
- Intrument calibration
- Blank analyses
- Surrogate recovery
- Matrix spike/matrix spike duplicate analyses
- Field duplicate analyses

Data are tabulated and the appropriate qualifiers are indicated in the attached Table A. Results obtained from both the initial and repeat analyses of those 14 samples which were reanalyzed are listed in the table. The results of the initial analyses should be used in eight samples (SH00-FB-DEC18Y, SH00-RB-DEC18X, SH02-GW-MW301A, SH02-GW-MW302A, SH03-GW-MW202A, SH04-SE-001-1, SH04-SW-002-1, and SH05-GW-MW501A); the reanalysis results in five samples (SH05-SU-SB501B, SH05-SU-SB501C, SH05-SU-SB502A, SH05-SU-SB502B, and SH07-SU-MW702A); and in one sample (SH04-RB-DEC12X) the results of the initial analysis should be used for the acid fraction and the results from the repeat analysis for the base-neutral fraction.

Both positive and non detected results in three samples (SH00-RB-DEC8X, SH03-GW-MW202A-RE, and SH04-RB-DEC12X-RE) are qualified as estimated ("J" and "UJ") because they were extracted beyond the holding times.

Relative percent factors less than the 0.05 criteria on initial or continuing calibration have resulted in the non-detectable results for 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-chloroaniline, and 4,6-dinitro-2-methylphenol being qualified with an (R) in associated samples. The percent relative standard deviation on initial calibrations and percent difference on continuing calibration for several compounds greatly exceeded the criteria (i.e., they were greater than 50 percent when the criteria are 30 percent and 25 percent, respectively). No positive results were detected in the associated samples. Non-detectable results for 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-chloroaniline, 4-nitrophenol, benzoic acid, 3,3'-dichlorobenzidine, bis(2-ethylhexyl)phthalate, pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene have been qualified "UJ". Positive results for bis(2-ethylhexyl)phthalate have been qualified "J" in associated samples for the percent difference on continuing calibration exceeding the criteria of 25%.

Laboratory and field blanks contained bis(2-ethylhexyl)phthalate. Consequently, positive results for this parameter in associated samples which are <10x the blank value have been qualified with a "U" if they are greater than the CRQL or raised to the CRQL and qualified with a "U" if they were detected at less than the CRQL.

Surrogate recoveries were less than 10% in the acid fraction on both the initial and repeat analyses of sample SH03-GW-MW202A and the base-neutral fraction on the initial analysis of sample SH04-RB-DEC12X. Consequently, these data have been qualified as rejected (R).

The base-neutral fraction in sample SH11-GW-MW11-1A has been qualified "UJ" because of low surrogate recoveries.

Results in seventeen samples have been qualified J or UJ because the internal standard areas were less than 50% of the associated continuing calibration. Seven other samples had internal standard areas which were more than 100% greater than the associated continuing calibration. However no action was taken on these samples because there were not positive hits.

No action was taken based on matrix spike/matrix spike duplicates or field duplicates.

RET/lmd
Attachments

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-5-9-116

TO: DOUGLAS HODSON

FROM: PATRICK J. BYRNE PJB

SUBJECT: SHEPPARD AIR FORCE BASE INORGANIC DATA VALIDATION

DATE: MAY 2, 1989

COPIES: RICH CAMBOTTI
KEITH STANG

Sixty-three samples from Sheppard AFB were collected for Sample Event 1B and analyzed for priority pollutant metals at MetaTrace Laboratory. There are 35 soil samples and 28 water samples in this package, each matrix type includes one pair of field duplicates. The data package for these samples was evaluated using the "EPA National Functional Guidelines for Evaluating Inorganics Analyses". The review considers the following performance factors:

- o Holding times
- o Calibration
- o Lab and field blanks*
- o ICP interference check sample analysis
- o Laboratory control sample analysis
- o Lab and field duplicates*
- o Matrix spike recoveries*
- o ICP serial dilution analysis*

*Exceptions to the acceptance criteria are discussed below.

Blanks

Lab and/or field blanks had positive values for Be, Cr, Cu, Pb, Hg, Ni and Zn. Sample values for these metals that were less than 5x the maximum blank level were qualified as undetected "U" to reflect the potential for blank contamination. Table 1 lists the blank values and the samples affected.

Spike Recoveries

Matrix spike recoveries of Sb, Ag, Cu, Se, and Ti were outside the acceptance range of 75-125%. Table 2 lists the analyte, the matrix spike recovery, the samples affected and the qualification for the results.

Duplicate Results

Lab duplicate results that exceed the Relative Percent Difference (RPD) acceptance limits of 25% for water and 35% for soil matrices indicate that the sample precision may vary significantly from the Quality Control associated with this analytical procedure. Qualify all positive sample data as approximate "J" as shown in Table 3.

Note

The lab results did not satisfy contractual specifications. Matrix spike recoveries, serial dilution, %D and duplicate RPDs were not calculated correctly by lab personnel. These calculations were corrected during the validation review process. The corrected values for these QC measures are attached.

ICP Serial Dilutions that were reported on Form IX and the qualifier codes (E) applied to Form I are not required since all sample concentrations are less than 50x the IDL.

The data summary table is attached.

Please contact me if you have any questions concerning these actions.

PJB/lmd
Attachments

TABLE 1

BLANK SUMMARY

Analyte	Concentration	Action
Be (FB)	3.7	"U" < 18.5 ug/l
Cr (FB)	11.1	"U" < 56
Cu	18.3 ug/l	"U" < 93
Pb (FB)	13.2	"U" < 66
Hg	0.72 mg/kg	"U" < 3.6 mg/kg
Ni (FB)	39.2	"U" < 200 ug/l
Zn	7.8	"U" < 40 ug/l

TABLE 2

MATRIX SPIKE RECOVERIES

Analyte	%Recovery	Action ND	Action Positive	Samples Affected
Sb	1.8	R	J	AA23312-23318
Cd	154	---	J	AA23434-AA23437
Ag	40	UJ	J	
Cd	130	---	J	AA23452-23455
Sb	5	R	J	AA23554-23558
Ag	58	J	J	
Tl	74	J	J	
Sb	0	R	J	AA23300-23307
Cu	66	J	J	
Se	63	J	J	
Ag	62	J	J	
Sb	36	J	J	AA23541-23553
Ag	0	R	J	
Cd	128	---	J	AA23875-23885
Cu	73	UJ	J	
Tl	43	J	J	
Sb	6	R	J	AA23438-444
As	67	J	J	
Cr	126	---	J	
Cu	40	J	J	
Sb	0	R	J	AA23625-23631,
Cr	34	UJ	J	23868, 23869,
Ni	72	UJ	J	23874

TABLE 3

DUPLICATE SAMPLE RESULTS

Analyte	RPD	Sample	Action
Pb	112%	AA23312-23316, AA23434-23437	J
Zn	23%	AA23312-23316, AA23434-23437	J
Cu	77%	AA23300-23307	J
Cu	66%	AA23875-23885	J
Zn	122%		J

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-5-9-18

TO:	DOUGLAS HODSON	DATE:	MAY 3, 1989
FROM:	MARY S. ROBISON MSR	COPIES:	RICH CAMBOTTI HAIA ROFFMAN KEITH STANG
SUBJECT:	DATA VALIDATION FOR RADIOLOGICAL ANALYSES, SHEPPARD AFB, BATCH 2		

The set of samples for Sheppard AFB, Batch 2, contained three soil samples and five water samples, including three field or rinsate blanks.

All parameters were successfully analyzed in all samples. The findings offered in this report are based upon a general review of all available data, including blank analysis results, calibration data, matrix spike and duplicate results.

Raw data and data interpretation records were submitted for gamma spectroscopy. The laboratory states that a mixed gamma source was counted prior to each use to confirm the energy vs. channel calibration established for the sample geometry. No performance checks on energy calibration, resolution, efficiency, or background were discussed and no records were submitted. However, there is no reason to question the analytical results, and all gamma spectroscopy results are considered acceptable for use.

For the gross alpha and gross beta determinations, method spikes, duplicates, and blanks were analyzed. Spike recoveries were 79.5% for gross alpha and 74.7% for gross beta. Blanks were <1 pCi/L for both gross alpha and gross beta. Samples SHBB-GW-BB01A and SH00-FB-DEC18Y were analyzed in duplicate. Results were within counting error.

	SHBB-GW-BB01A		SH00-FB-DEC18Y	
pCi/L	Sample	Duplicate	Sample	Duplicate
gross alpha	<7	<8	<3	<3
gross beta	16 ± 9	20 ± 8.9	<6	<6

However, the reported gross beta value for SHBB-GW-BB01A is qualified as undetected, "U", because it is less than the gross beta activity found in field blank SH00-FB-DEC18X.

Standards and blanks were counted and duplicates were analyzed for radium-226 and radium-228. Blanks were <1 pCi/L. Sample SH00-RB-DEC18X was run in duplicate for both radium analyses with results <1 pCi/L. This samples was a rinsate blank. Standard % recovery for radium-226 analysis was 83%. All radium-226 data are acceptable for use. Positive results for radium-228 are qualified as estimated, "J", because the standard % recovery was only 63%.

The data were reviewed with reference to "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA-600/4-80-032.

MSR/lmd

TABLE 1

SHEPPARD AFB, BATCH 2

Summary of Qualifiers on Data Summary after Data Validation

Analyte	Samples Affected	Positive Values	Bias	Comments
Gross Beta	SHBB-GW-BB01A	U	High	1
Radium-228	SHBB-GW-BB01A, SH11-GW-MW11-1A	J	Low	2 (63%)

Comment Codes:

1 Analyte less than the concentration found in a field blank

2 Standard %R < 75%

C-34-5-9-152

TO: DOUGLAS HODSON

DATE: MAY 17, 1989

FROM: HAIA ROFFMAN HKR

COPIES: RICH CAMBOTTI
KEITH STANG

SUBJECT: VOC DATA VALIDATION OF SAMPLES FROM SHEPPARD AIR FORCE BASE, SEMIVOLATILE COMPOUNDS - METATRACE LABORATORY

Data for thirty-five (35) samples, consisting of seventeen (17) soils and eighteen (18) water samples, analyzed by MetaTrace, Inc. for semivolatile organic compounds were reviewed. The data evaluation was based on the following criteria:

- o Data completeness
- o Holding times
- o GC/MS tuning and performance
- o Surrogate spike recovery
- o Matrix spike recovery
- o Laboratory and field blank analyses
- o Detection limits
- o Initial and continuing calibration
- o Duplicate sample analysis

The data package submitted by MetaTrace was eventually complete. The data results are summarized in the attached Table A.

Contract requirements were met for GC/MS tuning and performance criteria, blank analysis. The GC and spectral identifications were satisfactory. The reagent blanks were free of contamination.

On November 10, 1988, (3) soil samples and (1) water sample were received for BNA analysis. These samples were extracted on 11/14/88 and 11/16/88. Samples AA21753 and AA21754 were a MS and a MSD of sample AA21742. These samples were analyzed on 11/24/88, 11/30/88, and 12/01/88.

On November 12, 1988, (6) soil samples were received for BNA analysis. These samples were extracted on 11/16/88 and analyzed on 11/30/88. No MS or MSD was run with this set of samples.

On November 16, 1988, (5) water samples were received for BNA analysis. A spike blank and method blank were run with these samples in lieu of a MS and a MSD due to inadequate sample volume received. These samples were extracted on 11/18/88 and analyzed on 12/01/88.

On November 15, 1988, (8) soil samples and (11) water samples were received for BNA analysis. A MS and MSD were extracted and analyzed with these samples. These samples were extracted on 11/17/88 and were analyzed on 12/06/88 (AA21938) and on 12/27/88 (all others). Sample AA21938 was extracted slightly outside of its hold time. One soil sample had one surrogate outside of QC limit. On the MS and MSD, 4 of 11 RPDs were outside QC limits and 5 of 22 MS/MSD recoveries were outside of limits. One soil sample had ISTD outside QC limits; it was re-analyzed and was still outside QC limits which indicates the presence of matrix effects in these samples.

On November 18, 1988, (6) water samples were received for BNA analysis. These samples were extracted on 11/22/88 and analyzed on 12/03/88. A MS and a MSD were extracted and analyzed with these samples.

On November 22, 1988, (7) water samples were received for BNA analysis. These samples were extracted on 11/24/88 and analyzed on 12/06/88 (AA22256), on 11/03/88 (AA22264) and the rest on 12/16/88. The hold time on sample AA22264 was slightly missed.

No semivolatile compounds were detected for the 35 samples analyzed in this sample batch, except for several relatively low values of several phthalate compounds. Phthalates are known plastisizer compounds and are probably found in these samples due to the use of plastic gloves during sampling. Thus, the detection limit of these compounds should be raised (U). Action is taken in Table A.

Based on the QA/QC data review the results provided in this data package are acceptable.

HKR/lmd
Attachments

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-8-9-199

TO: DOUG HODSON

DATE: AUGUST 28, 1989

FROM: MATTHEW BARTMAN MB

COPIES: RICH CAMBOTTI
KEITH STANG

SUBJECT: SHEPPARD AIR FORCE BASE
SH2 ORGANIC DATA VALIDATION
SURFACE SOILS AND SUBSURFACE SOILS

NUS Pittsburgh analyzed six samples for volatiles, ten samples for base neutral/acid extractables, five samples for PAHs, and twenty five samples for pesticides. The data were reviewed with reference to "EPA Functional Guidelines for Organic Data Validation" and the Hazardous Waste Remedial Action Program's (HAZWRAP) "Requirements for Quality Control of Analytical Data". These analyses were performed under the HAZWRAP Level D QA/QC requirements. The data were evaluated based on the following criteria.

- Holding times
- GC/MS tuning and mass calibration
- Surrogate spike recovery
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory and field blank analyses
- Initial and continuing calibration
- Internal standards performance
- Detection limits

The data package was complete as submitted and qualified sample results are summarized in Table A. Holding times, GC/MS tuning and mass calibration, internal standards performance and detection limits met contract required criteria. Unacceptable criteria are listed below.

Volatile Fraction

All samples were analyzed as low level analyses.

One spike recovery was outside the quality control limits. No qualification of the data is necessary.

A review of the rinsate, trip, and laboratory method blank results yielded acetone, carbon disulfide and methylene chloride contamination. Consequently, values for these compounds below five or ten, depending on the analyte, times that reported in the blanks have been qualified undetected "U".

Semivolatile Fraction

All samples were analyzed as low level analyses.

Five spike recoveries were outside quality control limits. No qualification of the data is necessary.

Several reported values for Di-n-butylphthalate, bis(2-ethylhexylphthalate), pyrene, benzo(b)fluoranthene, benzo(a)pyrene, and di-n-butyl phthalate, have been qualified estimated "J", these values are below the CRQL and values below the CRQL are not of the 99 percent confidence level.

Pesticide Fraction

Several samples required elevated dilutions in order to accurately quantify results. Consequently, sample results reported on Table A are the results from several analyses.

Based on the data submitted, these data should be accepted as qualified. Necessary, supportive documentation depicting non-compliant data is attached in Appendix A. Please do not hesitate to contact me with any questions regarding this review.

MDB/lmd
Attachments

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-8-9-201

TO: DOUG HODSON

DATE: AUGUST 28, 1989

FROM: RICH CAMBOTTI

COPIES: MATT BARTMAN
HAIA ROFFMAN
KEITH STANG

SUBJECT: SHEPPARD AIR FORCE BASE
DATA VALIDATION, MISCELLANEOUS ANALYSES
OF SOIL SAMPLES; CASE: SH2
SAMPLES: SH08-SS-SS802A, SH08-SU-MW802A,
SH13-SU-MW13-1A, SH13-SU-MW13-2A, SH13-SU-MW13-2AD,
SH02-SU-MW204A, SH02-SU-MW204B, SH03-SS-SS304A,
SH02-SS-SS204A, SH08-SS-SS803A, SH08-SS-SS804A,
SH08-SU-MW802B, SH08-SU-MW802C, SH08-SU-MW803A,
SH08-SU-MW803B, SH08-SU-MW803C, SH13-SU-MW13-4A,
SH13-SU-MW13-3A, SH02-SS-SS502A, SH02-SS-SS206A,
SH02-SS-SS207A, SH02-SS-SS208A, SH02-SS-SS209A,
SH02-SS-SS210A, SH02-SS-SS211A, SH02-SS-SS212A,
SH02-SS-SS213A, SH02-SS-SS214A, SH02-SS-SS215A,
SH02-SS-SS215AD, SH03-SS-SS305A, SH03-SS-SS306A,
SH03-SS-SS307A

NUS Laboratory analyzed thirty-three soil samples from Sheppard Air Force Base for some or all of the following parameters:

- pH (required for CLP organic extraction) - all samples
- % moisture (required for calculation of soil sample contaminant results) - all samples
- Petroleum hydrocarbons - 9 samples
- Cation Exchange Capacity - 5 samples
- Total Organic Carbon - 8 samples

All samples were successfully analyzed except SH00-RB-JUL15-X, an equipment rinsate blank, for which an insufficient amount of the sample was received by the lab for the analysis of petroleum hydrocarbons. The samples were analyzed according to the prescribed EPA methods and Hazardous Waste Remedial Acton Program (HAZWRAP) QA/QC Level E criteria and deliverables. Data validation was based on some or all of the following criteria:

- Laboratory blank analysis
- Laboratory blank spike recovery
- Matrix spike/matrix spike duplicate analyses
- Laboratory duplicate, replicate and/or field duplicate analysis
- Initial and continuing calibration standard analysis

Requirements for all criteria were met. However, relative percent differences (RPDs) for matrix spike/matrix spike duplicate analysis were incorrectly calculated by the laboratory. The laboratory was notified and the calculations were recalculated and found to be acceptable.

These results should be accepted without qualification. If you have any questions, please call.

RKC/lmd

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-8-9-203

TO:	**DOUG HODSON**	**DATE:**	**AUGUST 29,1989**
FROM:	**MATTHEW BARTMAN** MB	**COPIES:**	**RICH CAMBOTTI** **KEITH STANG**

SUBJECT: SHEPPARD AIR FORCE BASE
SH1 ORGANIC DATA VALIDATION
MONITORING WELL / GROUNDWATERS

NUS Pittsburgh analyzed twenty four samples for volatiles, and sixteen samples for base neutral/ acid extractables. Included as part of these samples is one field blank, three rinsate blanks, and three trip blanks. The data were reviewed with reference to "EPA Functional Guidelines for Organic Data Validation" and the Hazardous Waste Remedial Action Program's (HAZWRAP) "Requirements for Quality Control of Analytical Data." These analyses were performed under the HAZWRAP Level D QA/QC requirements. The data were evaluated based on the following criteria.

> Holding times
> GC/MS tuning and mass calibration
> Surrogate spike recovery
> Matrix spike/ matrix spike duplicate (MS/MSD) results
> Laboratory and field blank analyses
> Initial and continuing calibration
> Internal standards performance
> Detection limits

The data package was complete as submitted and qualified sample results are summarized in Table A. Holding times, GC/MS tuning and mass calibration, internal standards performance and detection limits met contract required criteria. Unacceptable criteria are listed below.

<u>Volatile Fraction</u>

> All samples were analyzed as low level analyses.
> A review of the rinsate, trip, and laboratory method blank results yielded acetone, methylene chloride, chloroform, and toluene, Cosequently, values for these compounds below ten times that reported in the blanks have been qualified undetected "U."
> The reported values for trichloroethene, 1,2-dichloroethane, benzene and toluene in several samples have been qualified estimated "J." These values are below the Contract Required Detection Limit (CRQL) and values reported below the CRQL are not of the 99% confidence level.

> The relative response factor for 2-Butanone in the continuing calibration was less than 0.05. Consequently, the quantitation limit for several samples has been qualified unacceptable "R."

Semivolatile Fraction

> All samples were analyzed as low level analyses.
> A review of the field blank results yielded bis(2-ethylhexyl)phthalate. Consequently, values reported for this compound less than ten times the concentration repoted in the blank have been qualified "U."
> The reported values for diethylphthalate, Di-n-butylphthalate, in several samples has been qualified estimated "J", these values are below the Contract Required Detection Limit. Values below the contract required detection limit are not 99% confident.

Pesticide Fraction

> No action was necessary for this fraction

Based on the data submitted, these data should be accepted as qualified. Necessary, supportive documentation depicting non-compliant data is attached in Appendix A. Please do not hesitate to contact me with any questions regarding this review.

To: Doug Hodson
From: Thomas Jackman

August 30, 1989

cc: Haia Roffman
Keith Stang
Rich Cambotti

SUBJECT: Inorganic Data Validation
Shephard Air Force Base
SH2

NUS Laboratories analyzed 11 soil samples plus 2 rinsate blanks and 1 field blank (Two of these blanks are in sample set SH1) from Shephard Air Force Base for priority pollutant metals under the following HAZRAP Level D QA/QC criteria:

- Holding Times
- Interference Check Samples
- * - Matrix and Analytical Spike results
- * - Laboratory and Field Blank analysis
- Initial and Continuing Calibration
- * - Laboratory and Field Duplicates
- Serial Dilutions
- Detection limits

* Indicates that quality control criteria were not met for this parameter.

Blanks

Zinc was found in field blanks. Positive results less than 5 times the highest blank concentrations are qualified as "U", undetected.

Matrix Spikes

The matrix spike recovery for antimony was below the 30 % quality control limit. Therefore positive results are qualified "J", biased very low and detection limits are qualified "R", unreliable with a very low bias.

The matrix spike recovery for arsenic was below the 75 % quality control limit. Therefore positive results are qualified "J", biased low.

Analytical Spikes

An analytical spike recovery for selenium was below the 85 % quality control limit in one sample. Therefore the detection limit of selenium in this sample is qualified "UJ", estimated with a low bias.

Laboratory Duplicates

Relative Percent Difference (RPDs) for lead exceeded the 35 % quality control limit for soils. Therefore positive results for lead are qualified "J", estimated.

Note

Reported results for arsenic and beryllium were below contract required detection limits (CRDL) and above instrument detection limits (IDL) in some samples. These have been placed in brackets [] on the data summary.

Nickel has been labeled with an "N" on Form I's indicating a matrix spike problem. The data, however, do no support the need for the "N" qualifier. Therefore nickel has not been qualified in this sample set because of matrix spikes.

The data were reviewed according to Air Force QA/QC Guidelines in conjunction with EPA Region I CLP data validation guidelines and the National Functional Guidelines for Evaluating Inorganic Analyses.

Results should be accepted as per validation qualifiers employed.

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-34-8-9-224

TO: DOUG HODSON

FROM: MARY S. ROBISON MSR

SUBJECT: DATA VALIDATION FOR RADIOLOGICAL AND MISCELLANEOUS PARAMETERS, SHEPPARD AFB, CASE NO. SH1

DATE: AUGUST 31, 1989

COPIES: RICH CAMBOTTI
HAIA ROFFMAN
KEITH STANG

The set of samples for Sheppard AFB, Case No. SH1, contained 27 water samples, including two pairs of field duplicates and four field blanks, that were analyzed by NUS Laboratory Services. Seven samples were analyzed for radium-226 and radium-228, and the remaining 20 samples were analyzed for petroleum hydrocarbons.

The factors considered for petroleum hydrocarbons analysis were calibrations, method blanks, and blank spikes. These quality control data were acceptable. The laboratory also presented matrix spike and matrix spike duplicate data that were obtained on samples not part of this set. One matrix spike recovery indicated a high bias on initial analysis, and was within quality control limits on a repeat analysis of the same sample. Since all reported results from this set of samples are nondetected, and a high bias would result in false positives, the data are acceptable.

Dates of analysis for petroleum hydrocarbons were not specified for seven of the samples. Two minor transcription errors were found. One point is misplotted on a calibration curve, and the percent recovery for a blank spike is stated incorrectly. Neither of these errors affect the validity or the interpretation of the data.

Factors considered for radium analyses were background and performance checks, method blanks, matrix spikes, matrix spike duplicates, and standards (blank spikes).

Several problems were apparent with the reported radium-226 data. Detectable activity was found in the bottle blank. Application of the 5x any blank criterion according to the "Region I Functional Guidelines for Evaluating Inorganic Analyses" results in qualification of three of the reported sample values as undetected, "U". Also, the reported activities for field duplicates do not match within counting error, and the RPD for these duplicates is high (59%). Consequently, radium-226 resutls not already qualified are flagged as estimated, "J" or "UJ". Finally, the matrix spike, matrix spike duplicate, and standard (blank spike) percent recoveries are all low (47.7%, 57.3%, 63.6%), a fact which further supports qualification of these data.

The radium-228 data exhibit fewer problems. There is no detectable activity in the field blank, the field duplicates match within counting error, and the standard (blank spike) percent recovery is acceptable. However, the matrix spike and matrix spike duplicate results are low (61.7%, 59.3%), and the RPD for field duplicates is high (37.8%). Consequently, all radium-228 data are qualified as estimated, "J" or "UJ".

It is not possible to determine from these data whether the combined radium-226 and radium-228 maximum contaminant level of 5 pCi/L is actually exceeded, especially since the field duplicates do not match for the only sample which exceeds 5 pCi/L in these combined analyses. However, the low bias indicated by spikes suggests that the possibility of exceedance of this level does exist for sample 03-GW-MW302B.

MSR/lmd
Attachments

TO: DOUG HODSON

DATE: AUGUST 31, 1989

FROM: DEBRA SCHEIB

COPIES: RICH CAMBOTTI
KEITH STANG

SUBJECT: SHEPPARD AFB (ROUND 2) METATRACE LABORATORY DATA RESUBMISSION EFFECT ON REPORTED RESULTS - VALIDATION LETTERS C-34-4-9-162 AND C-34-4-9-154

Resubmissions of volatile (VOA) and base neutral/acid extractable (BNA) data were reviewed and impact on previously reported results was evaluated. Quality criteria in question include percent surrogate recovery (%R) and internal standard recovery and percent relative standard deviation (%RSD), percent difference (%D) for initial and continuing calibration. Changes in surrogate recovery and calibration quality criteria had minimal impact to the database as most samples contained no positive hits.

Data pertaining to the validation letters listed above are arranged into five sets of Metatrace cases. Each set is discussed separately below. Only changes significant enough to impact previously reported data are presented.

Data Set #1
MetatraceCase No. S26, S27-32 (Volatile)
Metatrace Case No. 1, 11 (Semivolatile)

NUS Sample Number	Metatrace Lab Number	
SH04-SE-001-1	AA23434	
SH04-SE-002-1	AA23435	
SH04-SS-001-1	AA23436	
SH04-SS-002-1	AA23437	
SH02-SS-001-1	AA23438	
SH02-SS-002-1	AA23441	
SH02-SS-003-1	AA23442	
SH05-SU-SB501A	AA23445/AA23541	
SH05-SU-SB501B	AA23446/AA23544	
SH05-SU-SB501C	AA23447/AA23545	
SH05-SU-SB502A	AA23448/AA23546	
SH05-SU-SB502B	AA23449/AA23547	
SH05-SU-SB502C	AA23450/AA23548	
SH00-TB-DEC07-X	AA23451	(VOA only)
SH04-SW-001-1	AA23452	
SH04-SW-002-1	AA23453	
SH12-SU-BB01A	AA23443	(BNA only)
SH12-SU-BB01B	AA23444	(BNA only)
SH05-SU-MW503B	AA23550	

SH05-SU-MW503C	AA23551	
SH08-SS-001-1	AA23552	
SH07-SU-MW702A	AA23553	
SH08-SS-001-0	AA2355	
SH07-SU-MW702B	AA23554	
SH05-SU-MW503A	AA23549	
SH00-RB-DEC08-X	AA23556	
SH00-TB-DEC09-X	AA23557	(VOA only)
SH00-FB-DEC09-X	AA23558	
SH07-SU-MW702C	AA23555	

Resubmitted data show that volatile initial calibration response factors for t-1,3-dichloropropene and toluene exceeded 30% RSD. No qualification resulted as no positive results were reported for these compounds. The corrected %RSD for vinyl chloride exceeded 50%; its detection limits in affected samples has been qualified as estimated, "UJ".

The corrected %D for vinyl chloride exceeded quality criteria for most continuing calibrations. In addition, corrected %D>25 were resubmitted for toluene, 1,2-dichloropropane, c-1,3-dichloropropene, t-1,3-dichloropropene, dibromochloromethane, 1,1,2-trichloroethane and benzene. No qualification resulted as no positive results were reported for these compounds in affected sam-ples. The corrected %D for vinyl acetate exceeded 50% for one con-tinuing calibration. Its detection limit in affected samples has been qualified as estimated, "UJ".

The corrected %D reported for semivolatile compounds di-n-octyl phthalate and benzo-a-pyrene exceeded 50%. Detection limits for these compounds in affected samples have been qualified as estimated, "UJ". The 25%D quality criteria for several BNA compounds (benzo-a-pyrene, fluoranthene, di-n-octyl phthalate and n-nitroso-diphenylamine), was exceeded for several continuing calibrations. No action was required as no positive results were reported for these analytes.

Data Set #2
Metatrace Case No. S1 & S2 (Volatile)
Metatrace Case No. 14 (Semivolatile)

NUS Sample Number	Metatrace Lab Number
SH11-SU-SB11A	AA23625
SH04-SU-SB403A	AA23626
SH04-SU-SB403C	AA23630
SH04-SU-SB403B	AA23629
SH04-RB-DEC12-X	AA23631
SH04-TB-DEC12-X	AA23632

Resubmitted toluene-d8 sample surrogate recoveries and the toluene-d8 surrogate recovery for the associated method blank analyzed are below quality limits. Consequently, all VOA data for this sample set is considered estimated. No positive results were reported; all detection limits have been qualified, "UJ".

Percent RSD and %D for several compounds exceeded 50%. All data has been previously qualified based on surrogate recovery; no further qualification was applied.

Tabulated values reported for methylene chloride and acetone in samples SH04-SU-SB403A and SH04-SU-SB403C have been corrected as per resubmitted data.

Internal standard #3 recovery was below the lower control limit for sample SH04-SU-SB403C. Compounds quantified using this internal standard are considered to be estimated. All results for this sam- have been previously qualified; no further action was taken.

Resubmitted data for semivolatile fraction analyses yielded no changes significant enough to impact previously reported data.

Data Set #3
Metatrace Case No. 3 & 4S (Volatile)
Metatrace Case No. 12 (Semivolatile)

NUS Sample Number	Metatrace Lab Number	
SHBB-GW-BB01A	AA23868	
SH00-RB-DEC18-X	AA23869	
SH00-TB-DEC18-Z	AA23870	(VOA only)
SH00-TB-DEC18-Y	AA23871	(VOA only)
SH00-TB-DEC18-X	AA23872	(VOA only)
SH00-FB-DEC19-Y	AA23873	
SH02-GW-MW301A	AA23874	
SH02-GW-MW302A	AA23875	
SH08-GW-MW801A	AA23878	
SH00-FB-DEC18-X	AA23879	
SH00-FB-DEC18-Y	AA23880	
SH00-RB-DEC19-X	AA23881	
SH05-GW-MW501A	AA23882	
SH05-GW-MW502A	AA23883	
SH05-GW-MW503A	AA23884	
SH11-GW-MW11-1A	AA23885	
SH04-GW-MW402A	AA23886	
SH04-GW-MW403A	AA23887	

The corrected %RSD for t-1,3-dichloropropene exceeded 30%. No qualification resulted as no positive results were reported for this compound. Corrected %RSDs and %Ds for vinyl chloride exceeded 50% for several calibrations. The detection limits for vinyl chloride for all samples in this data set have been qualified as estimated, "UJ".

The corrected %RSD for semivolatile compound di-n-octyl phthalate and several other compounds (n-nitroso-diphenylamine, pentachlorophenol and benzo-a-pyrene), exceeded the 30% quality criteria. The one positive value reported for di-n-octyl phthalate (sample SH05-GWMW-503A), has been qualified as estimated, "J".

Data Set #4
Metatrace Case No. S33 (Volatile)
Metatrace Case No. 13 (Semivolatile)

NUS Sanple Number	Metatrace Lab Number	
SH08-SS-SS001-A	AA24003	
SH03-GWMW-201A	AA24000	
SH03-GWMW-202A	AA24001	
SH00-TB-DEC20-X	AA24002	(VOA only)
SH00-FB-DEC20-X	AA24004	
SH07-GWMW-701A	AA24005	
SH07-GWMW-702A	AA24006	
SH00-TB-DEC20-Y	AA24007	(VOA only)
SH00-RB-DEC20-X	AA24008	

The corrected %RSD for t-1,3-dichloropropene exceeded 30%. No qualification resulted as no positive results were reported for this compound. Resubmitted %RSDs and %Ds for vinyl chloride exceeded 50%. The detection limits for vinyl chloride for all samples in this data set have been qualified as estimated, "UJ".

The corrected %D for semivilatile compounds di-n-octyl phthalate and benzo-a pyrene exceeded 50%. Detection limits for these compounds in affected samples have been qualified as estimated, "UJ".

Data Set #5
Metatrace Case No. S20-24 (Volatile)
Metatrace Case No. 2 (Semivolatile)

NUS Sample Number	Metatrace Lab Number	
SH08-SU-SB801A	AA23300	
SH07-SU-SB701A	AA23302	
SH07-SU-SB701B	AA23303	
SH07-SU-SB701C	AA23304	
SH03-SE-001-1	AA23305	
SH03-SS-001-1	AA23307	
SH08-SU-SB801B	AA23301	
SH12-SU-BB01A	AA23310	
SH12-SU-BB01B	AA23311	
SH03-SE-001-1D	AA23306	
SH00-RB-DEC06-X	AA23312	
SH03-SW-001-1	AA23313	
SH00-RB-DEC07-X	AA23314	
SH00-TB-DEC06-X	AA23315	(VOA only)
SH03-SW-001-1D	AA23316	

Resubmitted %RSDs for toluene and t-1,3-dichloropropene exceeded 30%. No qualification resulted as no positive results were reported for these compounds. Corrected %RSDs and %Ds for vinyl chloride exceeded 50%. All detection limits for vinyl chloride in this data set have been qualified as estimated, "UJ".

Resubmitted data for semivolatile fraction analyses yielded no changes significant enough to impact the previously reported data.

Some positive results (not previously qualified), reported for samples throughout these five data sets have been qualified as estimated, "J", as they are below the contract required detection limits.

Please do not hesitate to contact me if you have any questions regarding this review.

TO: DOUG HODSON

DATE: AUGUST 31, 1989

FROM: DEBRA SCHEIB

COPIES: RICH CAMBOTTI
KEITH STANG

SUBJECT: SHEPPARD AFB (ROUND 1) METATRACE LABORATORY DATA RESUBMISSION EFFECT ON REPORTED RESULTS - VALIDATION LETTERS C-34-4-9-147 AND C-34-5-9-152

Resubmissions of volatile (VOA) and base neutral/acid extractable (BNA) data were reviewed and impact on previously reported results was evaluated. Quality criteria in question include percent surrogate recovery (%R) and percent relative standard deviation (%RSD), percent difference (%D) for initial and continuing calibration. Changes in surrogate recovery and calibration quality criteria had minimal impact to the database as most samples contained no positive hits.

Data pertaining to the validation letters listed above are arranged into six sets of Metatrace cases. Each set is discussed separately below. Only changes significant enough to impact previously reported data are presented.

Data Set #1
Metatrace Case No. S19 (Volatile)
(no case no. assigned semivolatile)

NUS Sample Number	Metatrace Lab Number	
SH03-GWMW-302A	AA21921	
SH03-GWMW-302X	AA21924	
SH00-RB-NOV15-X	AA21925	
SH00-TB-NOV15-X	AA21926	(VOA only)
SH00-FB-NOV13-Y	AA21927	
SH00-FB-NOV13-Y	AA21928	

Some volatile surrogates that were previously reported as within quality criteria are now outside of QC limits (excessive). No qualification resulted as no positive VOA results (except for methylene chloride in sample SH00-FB-NOV13-Y) were reported for these analyses. The positive methylene chloride result was previously qualified.

Resubmitted data show that volatile initial calibration response factors for vinyl chloride exceeded 30% RSD. Corrected %RSDs were submitted for several other compounds as well. Recalculation of these %RSDs caused changes in continuing calibration %Ds which were not addressed. Appropriate validator calculated %Ds are presented below:

Compound	RF-IC	RF-CC	%D
vinyl chloride	0.29717	0.27102	8.80
total xylenes	0.43329	0.60644	39.96

No qualification resulted as no positive results were reported for these compounds. However, Metatrace should be contacted for resubmission of an appropriate Form VII.

There were no semivolatile data resubmissions, and consequently no BNA data changes, for this sample set.

Data Set #2
Metatrace Case No. S6 (Volatile)
Metatrace Case No. 6 (Semivolatile)

NUS Sample Number	Metatrace Lab Number	
SH07-GWMW-003A	AA22256	
SH07-GWMW-009A	AA22257	
SH07-GWMW-010A	AA22258	
SH00-RB-NOV19-X	AA22259	
SH00-TB-NOV19-Z	AA22260	(VOA only)
SH04-GWMW-004A	AA22261	
SH04-GWMW-007A	AA22262	
SH05-GWMW-012A	AA22263	
SH05-GWMW-014A	AA22264	
SH00-TB-NOV19-X	AA22265	(VOA only)
SH00-TB-NOV19-Y	AA22266	(VOA only)

Resubmitted data show that volatile initial calibration response factors for vinyl chloride exceeded 30% RSD. No qualification resulted as no positive results were reported for this compound. The corrected %D for total xylenes exceeded 50%. Detection limits for this compound have been qualified as estimated, "UJ".

The corrected %RSD for semivolatile compound n-nitroso-diphenylamine exceeded 30%. No qualification resulted as no positive results were reported for this compound. Corrected %Ds for acenaphthene, 4,6-dinitro-2-methyl phenol, n-nitroso-diphenylamine, pentachlorophenol, 4-methyl-3-chlorophenol, and fluoranthene exceeded 25%. No qualification resulted as no positive results were reported for these compounds.

Resubmitted %Ds for dimethyl phthalate, diethyl phthalate, hexachlorobenzene, phenanthrene and anthracene are now within 50% D. Estimation qualifiers, (UJ), previously applied to the detection limits for these compounds in affected samples have been deleted.

Data Set #3
Metatrace Case No. S17 & 18 (Volatile)
Metatrace Case No. 4 (Semivolatile)

NUS Sample Number	Metatrace Lab Number	
SH00-RB-NOV08-X	AA21745	
SH02-TB-NOV08-X	AA21749	(VOA only)
SH02-SU-MW201A	AA21742	
SH02-SU-MW201-X	AA21743	
SH02-SU-MW202A	AA21746	

The corrected %RSD for vinyl chloride exceeded 30%. No qualification resulted as no positive results were reported for this compound.

No new Form VII was resubmitted for continuing calibration #C5900, however, the case narrative indicates a change in vinyl chloride %D to outside of quality limits. Metatrace should be contacted for a copy of the appropriate Form VII. (If the corrected %D for vinyl chloride exceeds 50%, its detection limits in all affected samples require qualification, "UJ", as estimated.)

The resubmitted %RSD for semivolatile compound di-n-octyl phthalate is now within the 30% quality criteria. No positive values were reported for this compound, consequently, no positive estimation qualifiers, (J), had to be deleted. The resubmitted %RSD for n-nitroso-diphenylamine exceeded 30%. No qualification resulted as no positive values were reported for this compound.

The corrected %D for n-nitroso-diphenylamine exceeded 50%. Detection limits for this compound in affected samples have been qualified as estimated, "UJ". The corrected %Ds for hexachlorobutadiene, 4-chloro-3-methyl phenol, pentachlorophenol and fluoranthene exceeded the 25% quality criteria. No qualification resulted as no positive results were reported for these compounds.

Data Set #4
(no Metatrace case nos. assigned)

NUS Sample Number	Metatrace Lab Number
SH00-TB-NOV17-X	AA22139
SH03-GWMW-301A	AA22136
SH05-GWMW-0112A	AA22140
SH05-GWMW-013AX	AA22141
SH00-RB-NOV17-X	AA22142
SH00-TB-NOV18-Y	AA22143

There were no resubmissions, and consequently no data changes, for this sample set.

Data Set #5
Metatrace Case No. S12-16 (Volatile)
Metatrace Case No. 9 (Semivolatile)

NUS Sample Number	Metatrace Lab Number
SH00-RB-NOV12-X	AA21938
SH03-SU-MW301A	AA21943
SH03-SU-MW302A	AA21948
SH04-SU-MW402A	AA21934
SH04-SU-MW402B	AA21935
SH04-SU-MW402C	AA21936
SH04-SU-MW401A	AA21929
SH04-SU-MW401B	AA21932
SH04-SU-MW401C	AA21933

Some volatile surrogate recoveries for some trip blank analyses are now reported as outside of QC limits (excessive). No qualification resulted as no positive results were reported for affected samples; detection limits are unaffected.

Corrected %Ds for vinyl chloride exceeded 50%. Consequently, the detection limits for vinyl chloride in affected samples have been qualified as estimated, "UJ". The corrected %D for total xylenes exceeded 25%. No qualification resulted as no positive results were reported for this compound.

Resubmitted data for semivolatile fraction analyses show that the corrected %RSD for nitrobenzene is now within quality limits. No positive values were reported for this compound, consequently, no positive estimation qualifiers, (J), had to be deleted.

Data Set #6
Metatrace Case No. 7, 8 & 9S (Volatile)
Metatrace Case No. 10 (Semivolatile)

NUS Sample Number	Metatrace Lab Number	
S400-RB-NOV10-X	AA21846	
SH400-TB-NOV11-X	AA21845	(VOA only)
SH06-SS-SS603-A	AA21850	
SH06-SS-SS604-A	AA21851	
SH02-SU-MW203A	AA21852	
SH06-SU-MW601A	AA21847	
SHO6-SS-SS601A	AA21848	
SH06-SS-SS602A	AA21849	

Resubmitted data show that the %RSD for vinyl chloride and total xylenes exceeded 50%. Detection limits (not previously qualified), in affected samples have been qualified, "UJ", as estimated. Corrected %Ds for methylene chloride and chloroethane exceeded 25%. No qualification resulted as no positive results were reported for these compounds.

The corrected %D resubmitted for the semivolatile compound pentachlorophenol exceeded the 25% quality criteria. No qualification resulted as no positive results were reported for this compound.

Please do not hesitate to contact me if you have any questions regarding this review.

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APPENDIX G

ANALYTICAL DATA BASE

APPENDIX G

Please note that the analytical data base refers to "Phase I" and "Phase II" data sets. These correspond to "Round I" and "Round II" data referred to in the text.

APPENDIX G
TABLE OF CONTENTS

BASE BACKGROUND STATISTICAL ANALYSIS

SUBSURFACE SOILS AND GROUNDWATER

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH12 BASE BACKGROUND - GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
18		SELENIUM	1	4.1700	4.1700	4.1700	0.0000	4.1700
		CHLORIDE	1	90.7000	90.7000	90.7000	0.0000	90.7000
		NITRATE (as N)	1	65.9000	65.9000	65.9000	0.0000	65.9000
		SULFATE	1	62.4000	62.4000	62.4000	0.0000	62.4000
		TDS	1	796.0000	796.0000	796.0000	0.0000	796.0000
		FLUORIDE	1	0.8200	0.8200	0.8200	0.0000	0.8200
		BROMIDE	1	0.5000	0.5000	0.5000	0.0000	0.5000
		RADIUM 228 (pCi/g)	1	1.8000	1.8000	1.8000	0.0000	1.8000

3

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE 1) SH12 BASE BACKGROUND - SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	80.0000	80.0000	80.0000	0.0000	80.0000
3		ARSENIC	2	1.7000	2.0000	1.8500	0.1500	1.8439
8		CHROMIUM	2	9.0000	10.9000	9.9500	0.9500	9.9045
10		COPPER	2	20.0000	32.1000	26.0500	6.0500	25.3377
12		LEAD	2	5.6000	6.0000	5.8000	0.2000	5.7965
15		MERCURY	2	0.4000	0.4000	0.4000	0.0000	0.4000
16		NICKEL	2	13.4000	27.7000	20.5500	7.1500	19.2660
24		ZINC	2	27.4000	36.2000	31.8000	4.4000	31.4941
		CATION EXCHANGE CAPACITY MEQ/100G	1	10.6000	10.6000	10.6000	0.0000	10.6000
		GAMMA EMITTERS TH 232 (pCi/g)	2	0.8000	0.9000	0.8500	0.0500	0.8485
		GAMMA EMITTERS RA 228 (pCi/g)	2	0.7000	1.0000	0.8500	0.1500	0.8366
		GAMMA EMITTERS RA 226 (pCi/g)	2	0.6000	0.8000	0.7000	0.1000	0.6928

F

PHASE I GROUNDWATER STATISTICAL ANALYSIS - SITE BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: SHEPPARD AFB (PHASE I) SH02 GROUNDWATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
18		SELENIUM	1	1.6000	1.6000	1.6000	0.0000	1.6000
		CHLORIDE	2	7332.0000	7335.0000	7333.5000	1.5000	7333.4998
		NITRATE (as N)	1	58.6000	58.6000	58.6000	0.0000	58.6000
		SULFATE	2	1197.0000	2885.0000	2041.0000	844.0000	1858.3177
		TDS	2	11788.0000	18542.0000	15165.0000	3377.0000	14784.2178
		BROMIDE	2	2.5000	15.0000	8.7500	6.2500	6.1237

6

STATISTICAL ANALYSIS FOR SAMPLE TYPE: SHEPPARD AFB (PHASE I) SH03 GROUNDWATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	3.0000	3.0000	3.0000	0.0000	3.0000
10		COPPER	1	164.0000	164.0000	164.0000	0.0000	164.0000
18		SELENIUM	1	5.8200	5.8200	5.8200	0.0000	5.8200
24		ZINC	2	102.0000	104.0000	103.0000	1.0000	102.9951
		CHLORIDE	1	617.0000	617.0000	617.0000	0.0000	617.0000
		NITRATE (as N)	1	0.2600	0.2600	0.2600	0.0000	0.2600
		SULFATE	1	291.0000	291.0000	291.0000	0.0000	291.0000
		TDS	1	2914.0000	2914.0000	2914.0000	0.0000	2914.0000
		FLUORIDE	1	2.1000	2.1000	2.1000	0.0000	2.1000
		BROMIDE	1	2.9000	2.9000	2.9000	0.0000	2.9000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH04 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	1	7.0000	7.0000	7.0000	0.0000	7.0000
12		LEAD	1	2.0000	2.0000	2.0000	0.0000	2.0000
18		SELENIUM	3	7.0000	17.0000	12.5000	4.1433	11.7118
		CHLORIDE	4	2529.0000	3650.0000	3119.7500	397.4867	3093.6109
		CYANIDE UG/L	1	6.6300	6.6300	6.6300	0.0000	6.6300
		NITRATE (as N)	4	1.3000	9.7000	4.8500	3.0606	3.8481
		SULFATE	4	954.0000	1608.0000	1306.2500	297.5822	1271.5256
		TDS	3	1123.0000	14408.0000	8599.6667	5550.3939	5497.3886
		FLUORIDE	2	5.2000	6.9000	6.0500	0.8500	5.9899
		BROMIDE	4	14.1000	23.1000	17.6750	3.3811	17.3726
		PHOSPHATE, TOTAL UG/L	2	241.0000	279.0000	260.0000	19.0000	259.3048

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH05 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	110.0000	110.0000	110.0000	0.0000	110.0000
69B	117-84-0	DI-N-OCTYL PHTHALATE	1	6.0000	6.0000	6.0000	0.0000	6.0000
3		ARSENIC	1	4.0000	4.0000	4.0000	0.0000	4.0000
6		CADMIUM	1	8.0000	8.0000	8.0000	0.0000	8.0000
8		CHROMIUM	1	12.0000	12.0000	12.0000	0.0000	12.0000
16		NICKEL	3	22.0000	248.0000	104.5333	101.8288	61.9612
		CHLORIDE	7	43.9000	591.0000	283.4143	155.3556	228.9642
		NITRATE (as N)	7	8.7000	72.8000	35.7000	21.7208	27.9538
		SULFATE	7	33.7000	237.0000	146.2429	58.8658	127.6075
		TDS	7	330.0000	11343.0000	2480.7143	3635.4592	1298.7659
		FLUORIDE	3	0.7300	0.8700	0.7900	0.0589	0.7878
		BROMIDE	7	0.5500	1.8000	1.2714	0.4174	1.1883
		PHOSPHATE, TOTAL UG/L	4	44.1000	456.0000	171.2250	166.5798	112.2058

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH07 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	1	5.0000	5.0000	5.0000	0.0000	5.0000
10		COPPER	1	60.0000	60.0000	60.0000	0.0000	60.0000
12		LEAD	1	13.0000	13.0000	13.0000	0.0000	13.0000
16		NICKEL	2	38.2000	168.0000	103.1000	64.9000	80.1099
18		SELENIUM	1	3.0000	3.0000	3.0000	0.0000	3.0000

O

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE 1) SH08 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	1	4.1800	4.1800	4.1800	0.0000	4.1800
18		SELENIUM	1	2.6300	2.6300	2.6300	0.0000	2.6300

STATISTICA[illegible]LYSIS FOR SAMPLE TYPE: (PHASE I) SH11 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
		CHLORIDE	1	7370.0000	7370.0000	7370.0000	0.0000	7370.0000
		NITRATE (as N)	1	2.7000	2.7000	2.7000	0.0000	2.7000
		SULFATE	1	2254.0000	2254.0000	2254.0000	0.0000	2254.0000
		TDS	1	14635.0000	14635.0000	14635.0000	0.0000	14635.0000
		FLUORIDE	1	6.7000	6.7000	6.7000	0.0000	6.7000
		BROMIDE	1	21.6000	21.6000	21.6000	0.0000	21.6000
		RADIUM 226 (pCi/g)	1	2.4000	2.4000	2.4000	0.0000	2.4000
		RADIUM 228 (pCi/g)	1	3.4000	3.4000	3.4000	0.0000	3.4000

PHASE II GROUNDWATER STATISTICAL ANALYSIS - SITY BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH02 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
70B	84-66-2	DIETHYL PHTHALATE	3	2.0000	2.0000	2.0000	0.0000	2.0000
67B	85-68-7	BUTYL BENZYL PHTHALATE	1	12.0000	12.0000	12.0000	0.0000	12.0000
3		ARSENIC	4	4.2000	109.0000	49.7000	43.7074	24.9918
8		CHROMIUM	1	45.0000	45.0000	45.0000	0.0000	45.0000
16		SELENIUM	1	2.5000	2.5000	2.5000	0.0000	2.5000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH03 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	2	5.9000	20.3000	13.1000	7.2000	10.9439
16		NICKEL	1	26.0000	26.0000	26.0000	0.0000	26.0000
		RADIUM 226 (pCi/L)	1	3.5000	3.5000	3.5000	0.0000	3.5000
		RADIUM 228 (pCi/L)	3	2.2000	4.4000	3.2000	0.9092	3.0737

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH04 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
4V	71-43-2	BENZENE	1	5.0000	5.0000	5.0000	0.0000	5.0000
3		ARSENIC	1	10.8000	10.8000	10.8000	0.0000	10.8000
6		CHROMIUM	1	7.0000	7.0000	7.0000	0.0000	7.0000
18		SELENIUM	1	5.8000	5.8000	5.8000	0.0000	5.8000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH05 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
87V	79-01-6	TRICHLOROETHENE	1	3.0000	3.0000	3.0000	0.0000	3.0000
8		CHROMIUM	2	105.0000	1850.0000	977.5000	872.5000	440.7380
16		NICKEL	2	44.0000	161.0000	102.5000	58.5000	84.1665

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH07 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
8		CHROMIUM	1	500.0000	500.0000	500.0000	0.0000	500.0000
16		NICKEL	1	372.0000	372.0000	372.0000	0.0000	372.0000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH08 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
4V	71-43-2	BENZENE	2	1.0000	2.0000	1.5000	0.5000	1.4142
10V	107-06-2	1,2-DICHLOROETHANE	1	1.0000	1.0000	1.0000	0.0000	1.0000
87V	79-01-6	TRICHLOROETHENE	1	1.0000	1.0000	1.0000	0.0000	1.0000
68B	84-74-2	DI-N-BUTYL PHTHALATE	1	1.0000	1.0000	1.0000	0.0000	1.0000
70B	84-66-2	DIETHYL PHTHALATE	1	0.7000	0.7000	0.7000	0.0000	0.7000
	319-84-6	ALPHA-CHLORDANE	2	2.5000	2.7000	2.6000	0.1000	2.5980
103P	319-85-7	BETA-BHC	1	0.2100	0.2100	0.2100	0.0000	0.2100
100P	76-44-8	HEPTACHLOR	1	0.1500	0.1500	0.1500	0.0000	0.1500
	72-54-8	4,4'-DDD	1	0.4200	0.4200	0.4200	0.0000	0.4200
91P	57-74-9	GAMMA CHLORDANE	2	1.8000	2.0000	1.9000	0.1000	1.8973
3		ARSENIC	3	13.1000	17.7000	16.0000	2.0607	15.8583
16		NICKEL	1	16.0000	16.0000	16.0000	0.0000	16.0000
18		SELENIUM	1	5.7000	5.7000	5.7000	0.0000	5.7000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH11 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
		RADIUM 226 (pCi/L)	1	2.3000	2.3000	2.3000	0.0000	2.3000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH13 GROUND WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
4V	71-43-2	BENZENE	1	1.0000	1.0000	1.0000	0.0000	1.0000

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PHASE I SURFACE SOIL STATISTICAL ANALYSIS - SITE BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH02 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	3	60.0000	100.0000	76.6667	16.9967	74.8887
3		ARSENIC	3	1.7000	3.5000	2.7000	0.7483	2.5840
8		CHROMIUM	3	7.5000	63.5000	28.7000	24.8022	19.3020
10		COPPER	3	15.4000	38.2000	23.5667	10.3706	21.5870
12		LEAD	3	0.9200	21.9000	13.4400	9.0334	7.0646
15		MERCURY	3	0.3000	0.3000	0.3000	0.0000	0.3000
16		NICKEL	1	12.2000	12.2000	12.2000	0.0000	12.2000
24		ZINC	3	22.1000	35.5000	27.9667	5.5960	27.4278

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STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH03 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	1	1.9000	1.9000	1.9000	0.0000	1.9000
5		BERYLLIUM	1	0.9000	0.9000	0.9000	0.0000	0.9000
8		CHROMIUM	1	35.7000	35.7000	35.7000	0.0000	35.7000
10		COPPER	1	26.2000	26.2000	26.2000	0.0000	26.2000
12		LEAD	1	31.8000	31.8000	31.8000	0.0000	31.8000
15		MERCURY	1	0.3000	0.3000	0.3000	0.0000	0.3000
16		NICKEL	1	30.5000	30.5000	30.5000	0.0000	30.5000
24		ZINC	1	60.3000	60.3000	60.3000	0.0000	60.3000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH04 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
69B	117-84-0	DI-N-OCTYL PHTHALATE	1	60.0000	60.0000	60.0000	0.0000	60.0000
3		ARSENIC	2	2.4000	3.9000	3.1500	0.7500	3.0594
5		BERYLLIUM	2	1.2000	1.7000	1.4500	0.2500	1.4282
8		CHROMIUM	2	12.7000	17.9000	15.3000	2.6000	15.0774
10		COPPER	2	5.5000	5.9000	5.7000	0.2000	5.6964
12		LEAD	2	13.8000	16.6000	15.2000	1.4000	15.1353
15		MERCURY	2	0.2000	0.4000	0.3000	0.1000	0.2828
16		NICKEL	2	12.6000	19.5000	16.0500	3.4500	15.6748
24		ZINC	2	25.4000	29.8000	27.6000	2.2000	27.5121

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH06 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	4	3.4000	6.1000	4.7250	1.2774	4.5491
5		BERYLLIUM	4	0.8500	1.1000	0.9875	0.0893	0.9833
6		CADMIUM	1	1.0000	1.0000	1.0000	0.0000	1.0000
8		CHROMIUM	4	11.0000	19.0000	15.7500	3.1125	15.4126
12		LEAD	4	11.7000	13.7000	12.4250	0.7980	12.4000
16		NICKEL	4	9.6000	16.0000	13.4000	2.4454	13.1554

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH08 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	60.0000	60.0000	60.0000	0.0000	60.0000
39B	206-44-0	FLUORANTHENE	1	80.0000	80.0000	80.0000	0.0000	80.0000
84B	129-00-0	PYRENE	1	80.0000	80.0000	80.0000	0.0000	80.0000
3		ARSENIC	2	3.0000	5.3000	4.1500	1.1500	3.9874
6		CADMIUM	1	34.3000	34.3000	34.3000	0.0000	34.3000
8		CHROMIUM	2	10.0000	840.0000	425.0000	415.0000	91.6515
10		COPPER	2	24.8000	110.0000	67.4000	42.6000	52.2302
12		LEAD	2	32.4000	180.0000	106.2000	73.8000	76.3675
15		MERCURY	2	0.2100	0.6000	0.4050	0.1950	0.3549
16		NICKEL	2	12.3000	38.4000	25.3500	13.0500	21.7329
18		SELENIUM	1	0.9000	0.9000	0.9000	0.0000	0.9000
20		SODIUM	1	260.0000	260.0000	260.0000	0.0000	260.0000
24		ZINC	2	33.4000	450.0000	241.7000	208.3000	122.5969

STATISTICAL [illegible]SIS FOR SAMPLE TYPE: (PHASE I) SH09 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN

96

PHASE II SURFACE SOIL STATISTICAL ANALYSIS - SITE BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH02 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
93P	72-55-9	4,4'-DDE	1	25.0000	25.0000	25.0000	0.0000	25.0000
		% MOISTURE	13	0.1000	13.4000	2.7462	3.4640	1.3541
		PH	13	6.1000	8.3000	7.5077	0.5269	7.4879
		TOC	1	10000.0000	10000.0000	10000.0000	0.0000	10000.0000

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STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH03 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
104P	319-86-8	DELTA-BHC	1	17.0000	17.0000	17.0000	0.0000	17.0000
100P	76-44-8	HEPTACHLOR	1	200.0000	200.0000	200.0000	0.0000	200.0000
92P	50-29-3	4,4'-DDT	4	36.0000	85.0000	57.0000	17.9583	54.3045
93P	72-55-9	4,4'-DDE	4	19.0000	170.0000	84.2500	54.5865	64.7054
90P	60-57-1	DIELDRIN	1	150.0000	150.0000	150.0000	0.0000	150.0000
91P	57-74-9	GAMMA CHLORDANE	2	100.0000	270.0000	185.0000	85.0000	164.3167
		% MOISTURE	4	4.0000	20.9000	8.8750	7.0233	6.8541
		PH	4	5.6000	7.5000	6.7000	0.7906	6.6520
		TOC	1	15000.0000	15000.0000	15000.0000	0.0000	15000.0000

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STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH08 SURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
68B	84-74-2	DI-N-BUTYL PHTHALATE	3	270.0000	550.0000	366.6667	129.7005	346.4401
74B	205-99-2	BENZO(B)FLUORANTHENE	1	65.0000	65.0000	65.0000	0.0000	65.0000
73B	50-32-8	BENZO(A)PYRENE	1	54.0000	54.0000	54.0000	0.0000	54.0000
84B	129-00-0	PYRENE	2	31.0000	42.0000	36.5000	5.5000	36.0832
	319-84-6	ALPHA-CHLORDANE	1	2300.0000	2300.0000	2300.0000	0.0000	2300.0000
101P	1024-57-3	HEPTACHLOR EPOXIDE	1	42.0000	42.0000	42.0000	0.0000	42.0000
92P	50-29-3	4,4'-DDT	3	61.0000	1100.0000	697.0000	455.0436	396.6448
	72-54-8	4,4'-DDD	1	50.0000	50.0000	50.0000	0.0000	50.0000
93P	72-55-9	4,4'-DDE	2	56.0000	1400.0000	728.0000	672.0000	280.0000
91P	57-74-9	GAMMA CHLORDANE	1	2900.0000	2900.0000	2900.0000	0.0000	2900.0000
3		ARSENIC	3	1.6000	3.0000	2.4333	0.6018	2.3489
5		BERYLLIUM	3	0.4900	0.6000	0.5500	0.0455	0.5480
6		CADMIUM	3	0.6100	1.6000	1.1033	0.4042	1.0239
8		CHROMIUM	3	9.5000	16.5000	12.7667	2.8767	12.4462
10		COPPER	3	8.0000	15.4000	11.4333	3.0445	11.0326
12		LEAD	3	14.7000	89.0000	46.4667	31.2737	36.0129
15		MERCURY	1	1.7000	1.7000	1.7000	0.0000	1.7000
16		NICKEL	3	8.3000	12.3000	9.9333	1.7133	9.7931
19		SILVER	2	1.1000	2.4000	1.7500	0.6500	1.6248
24		ZINC	3	28.9000	99.8000	62.2000	29.1041	55.0683
		% MOISTURE	3	12.1000	18.5000	16.0333	2.8111	15.7639
		PH	3	6.8000	7.6000	7.1667	0.3300	7.1591
		CATION EXCHANGE CAPACITY (MEQ/100G)	1	24.5000	24.5000	24.5000	0.0000	24.5000
		TOC	1	9100.0000	9100.0000	9100.0000	0.0000	9100.0000

PHASE I SUBSURFACE SOIL STATISTICAL ANALYSIS - SITE BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH02 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	4	1.2000	2.5700	1.8625	0.4849	1.7976
5		BERYLLIUM	4	0.5200	1.4000	0.8125	0.3522	0.7485
8		CHROMIUM	4	14.0000	26.0000	20.7500	5.3561	20.0276
12		LEAD	4	2.5800	12.6000	6.7450	3.6482	5.7961
16		NICKEL	4	16.0000	24.0000	20.2500	3.7666	19.8951
24		ZINC	2	55.0000	65.0000	60.0000	5.0000	59.7913
		CATION EXCHANGE CAPACITY MEQ/100G	2	5.4000	7.6000	6.5000	1.1000	6.4062

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH03 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	3	1.6700	3.5600	2.5367	0.7795	2.4188
5		BERYLLIUM	3	1.0000	2.4000	1.5000	0.6377	1.3820
8		CHROMIUM	3	29.0000	34.0000	31.6667	2.0548	31.5991
12		LEAD	3	4.1000	5.7000	5.0667	0.6944	5.0159
16		NICKEL	3	30.0000	37.0000	34.3333	3.0912	34.1881
24		ZINC	3	54.0000	80.0000	63.3333	11.8134	62.3099
		CATION EXCHANGE CAPACITY MEQ/100G	1	38.8000	38.8000	38.8000	0.0000	38.8000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH04 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	8	0.8000	5.8000	3.0112	1.4526	2.6299
5		BERYLLIUM	9	1.1000	2.2000	1.4889	0.3635	1.4469
6		CADMIUM	2	1.0000	1.1000	1.0500	0.0500	1.0488
8		CHROMIUM	9	30.0000	47.6000	36.8444	6.5639	36.2864
10		COPPER	4	7.2000	12.0000	9.5500	1.7110	9.3946
12		LEAD	9	1.5200	14.8000	7.7156	3.9104	6.5870
15		MERCURY	2	0.2000	0.2000	0.2000	0.0000	0.2000
16		NICKEL	9	27.0000	42.3000	33.2444	4.6087	32.9408
19		SILVER	1	10.9000	10.9000	10.9000	0.0000	10.9000
24		ZINC	7	40.6000	83.0000	55.0714	13.8057	53.5235
		CATION EXCHANGE CAPACITY MEQ/100G	3	27.6000	38.6000	31.7333	4.8890	31.3784

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH05 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	9	1.3000	5.7000	2.7333	1.3540	2.4430
8		CHROMIUM	9	6.6000	18.3000	10.7556	3.2531	10.3124
10		COPPER	9	6.5000	34.9000	12.0444	8.4210	10.3452
12		LEAD	9	2.4000	59.0000	12.0444	16.9408	6.8423
15		MERCURY	8	0.1000	0.2000	0.1875	0.0331	0.1834
16		NICKEL	8	10.3000	31.9000	17.2375	6.2498	16.2905
24		ZINC	9	17.9000	130.0000	46.5556	32.8065	38.7261

38

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH06 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	1	4.1000	4.1000	4.1000	0.0000	4.1000
5		BERYLLIUM	1	1.2000	1.2000	1.2000	0.0000	1.2000
8		CHROMIUM	1	22.0000	22.0000	22.0000	0.0000	22.0000
12		LEAD	1	9.8400	9.8400	9.8400	0.0000	9.8400
16		NICKEL	1	20.0000	20.0000	20.0000	0.0000	20.0000
		CATION EXCHANGE CAPACITY MEQ/100G	1	16.9000	16.9000	16.9000	0.0000	16.9000

39

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH07 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	4	1.3000	42.4000	13.2250	17.0306	5.0881
5		BERYLLIUM	4	0.6000	2.2000	1.0250	0.6796	0.8628
6		CADMIUM	2	2.3000	2.8000	2.5500	0.2500	2.5377
8		CHROMIUM	6	8.0000	56.9000	26.1000	17.8185	20.5654
10		COPPER	6	14.3000	440.0000	103.9667	150.8688	51.2691
12		LEAD	6	1.8000	4.3000	3.1000	0.9274	2.9522
15		MERCURY	6	0.1000	0.3000	0.1833	0.0687	0.1698
16		NICKEL	6	11.7000	42.1000	23.9167	12.7445	20.9160
24		ZINC	6	24.6000	79.8000	41.8167	19.4934	38.1171
		CATION EXCHANGE CAPACITY MEQ/100G	1	9.4000	9.4000	9.4000	0.0000	9.4000

710

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH08 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
	91-57-6	2-METHYLNAPHTHALENE	1	23000.0000	23000.0000	23000.0000	0.0000	23000.0000
81B	85-01-8	PHENANTHRENE	1	5700.0000	5700.0000	5700.0000	0.0000	5700.0000
2		ANTIMONY	2	11.1000	13.9000	12.5000	1.4000	12.4213
3		ARSENIC	1	3.0000	3.0000	3.0000	0.0000	3.0000
5		BERYLLIUM	2	0.7000	1.9000	1.3000	0.6000	1.1532
8		CHROMIUM	2	10.7000	33.5000	22.1000	11.4000	18.9327
10		COPPER	2	51.0000	93.7000	72.3500	21.3500	69.1281
12		LEAD	2	4.6000	11.8000	8.2000	3.6000	7.3674
15		MERCURY	2	0.2000	0.2000	0.2000	0.0000	0.2000
16		NICKEL	2	6.4000	29.0000	17.7000	11.3000	13.6235
24		ZINC	2	49.2000	240.0000	144.6000	95.4000	108.6646
		CATION EXCHANGE CAPACITY MEQ/100G	1	10.4000	10.4000	10.4000	0.0000	10.4000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH11 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	1	1.8000	1.8000	1.8000	0.0000	1.8000
5		BERYLLIUM	1	1.4000	1.4000	1.4000	0.0000	1.4000
8		CHROMIUM	1	30.9000	30.9000	30.9000	0.0000	30.9000
10		COPPER	1	18.3000	18.3000	18.3000	0.0000	18.3000
12		LEAD	1	7.0000	7.0000	7.0000	0.0000	7.0000
15		MERCURY	1	0.1000	0.1000	0.1000	0.0000	0.1000
16		NICKEL	1	36.1000	36.1000	36.1000	0.0000	36.1000
24		ZINC	1	63.3000	63.3000	63.3000	0.0000	63.3000
		CATION EXCHANGE CAPACITY MEQ/100G	1	9.4400	9.4400	9.4400	0.0000	9.4400
		GAMMA EMITTERS TH 232 (pCi/g)	1	2.0000	2.0000	2.0000	0.0000	2.0000
		GAMMA EMITTERS RA 228 (pCi/g)	1	1.8000	1.8000	1.8000	0.0000	1.8000
		GAMMA EMITTERS RA 226 (pCi/g)	1	1.1000	1.1000	1.1000	0.0000	1.1000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH12 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	80.0000	80.0000	80.0000	0.0000	80.0000
3		ARSENIC	2	1.7000	2.0000	1.8500	0.1500	1.8439
8		CHROMIUM	2	9.0000	10.9000	9.9500	0.9500	9.9045
10		COPPER	2	20.0000	32.1000	26.0500	6.0500	25.3377
12		LEAD	2	5.6000	6.0000	5.8000	0.2000	5.7965
15		MERCURY	2	0.4000	0.4000	0.4000	0.0000	0.4000
16		NICKEL	2	13.4000	27.7000	20.5500	7.1500	19.2660
24		ZINC	2	27.4000	36.2000	31.8000	4.4000	31.4941
		CATION EXCHANGE CAPACITY MEQ/100G	1	10.6000	10.6000	10.6000	0.0000	10.6000
		GAMMA EMITTERS TH 232 (pCi/g)	2	0.8000	0.9000	0.8500	0.0500	0.8485
		GAMMA EMITTERS RA 228 (pCi/g)	2	0.7000	1.0000	0.8500	0.1500	0.8366
		GAMMA EMITTERS RA 226 (pCi/g)	2	0.6000	0.8000	0.7000	0.1000	0.6928

PHASE II SUBSURFACE SOIL STATISTICAL ANALYSIS - SITE BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH02 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
2		ANTIMONY	1	11.1000	11.1000	11.1000	0.0000	11.1000
3		ARSENIC	2	1.5000	4.4000	2.9500	1.4500	2.5690
5		BERYLLIUM	2	0.4300	0.5400	0.4850	0.0550	0.4818
6		CADMIUM	1	0.9700	0.9700	0.9700	0.0000	0.9700
8		CHROMIUM	2	11.4000	14.2000	12.8000	1.4000	12.7232
10		COPPER	2	5.5000	6.7000	6.1000	0.6000	6.0704
12		LEAD	2	7.5000	39.4000	23.4500	15.9500	17.1901
16		NICKEL	2	13.4000	19.6000	16.5000	3.1000	16.2061
19		SILVER	2	1.1000	2.1000	1.6000	0.5000	1.5198
24		ZINC	2	33.8000	44.6000	39.2000	5.4000	38.8282
		% MOISTURE	2	7.4000	7.8000	7.6000	0.2000	7.5973
		PH	2	7.8000	8.2000	8.0000	0.2000	7.9974
		TOC	2	99.0000	400.0000	249.5000	150.5000	198.9974

45

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH08 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	18.0000	18.0000	18.0000	0.0000	18.0000
68B	84-74-2	DI-N-BUTYL PHTHALATE	6	120.0000	510.0000	284.3333	138.6382	248.4948
	319-84-6	ALPHA-CHLORDANE	2	440.0000	19000.0000	9720.0000	9280.0000	2891.3664
92P	50-29-3	4,4'-DDT	1	69.0000	69.0000	69.0000	0.0000	69.0000
	72-54-8	4,4'-DDD	2	520.0000	66000.0000	33260.0000	32740.0000	5858.3274
93P	72-55-9	4,4'-DDE	1	120.0000	120.0000	120.0000	0.0000	120.0000
91P	57-74-9	GAMMA CHLORDANE	2	460.0000	17000.0000	8730.0000	8270.0000	2796.4262
2		ANTIMONY	1	9.1000	9.1000	9.1000	0.0000	9.1000
3		ARSENIC	6	0.3700	13.8000	6.0117	5.5110	3.0753
5		BERYLLIUM	5	0.3400	0.6600	0.4800	0.1322	0.4621
6		CADMIUM	1	1.8000	1.8000	1.8000	0.0000	1.8000
8		CHROMIUM	6	8.6000	24.4000	13.2000	5.5937	12.2525
10		COPPER	6	4.5000	67.0000	19.8500	21.6383	12.7728
12		LEAD	6	11.0000	141.0000	47.1500	47.5332	29.3150
15		MERCURY	1	4.0000	4.0000	4.0000	0.0000	4.0000
16		NICKEL	6	10.5000	18.4000	14.3667	2.6132	14.1233
19		SILVER	3	1.1000	7.3000	3.5667	2.6849	2.6433
24		ZINC	4	27.4000	194.0000	87.2250	67.6016	63.0085
		% MOISTURE	6	10.7000	19.1000	13.8833	2.7823	13.6226
		PH	6	7.9000	10.3000	8.6167	0.7946	8.5827
		PETROLEUM HYDROCARBONS	3	78.0000	180.0000	118.6667	44.1311	111.2237
		CATION EXCHANGE CAPACITY (MEQ/100G)	1	15.5000	15.5000	15.5000	0.0000	15.5000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASEII) SH13 SUBSURFACE SOILS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
		% MOISTURE	5	12.9000	15.4000	14.0200	0.9130	13.9904
		PH	5	7.0000	7.9000	7.5400	0.3382	7.5322
		CATION EXCHANGE CAPACITY (MEQ/100G)	3	13.1000	27.0000	20.6667	5.7413	19.7860
		TOC	3	66.0000	2500.0000	1455.3333	1023.1277	667.1940

PHASE I SEDIMENT STATISTICAL ANALYSIS - SITE BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH03 SEDIMENTS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	2	2.6000	2.9000	2.7500	0.1500	2.7459
5		BERYLLIUM	1	1.1000	1.1000	1.1000	0.0000	1.1000
8		CHROMIUM	2	68.9000	77.2000	73.0500	4.1500	72.9320
10		COPPER	2	44.0000	51.4000	47.7000	3.7000	47.5562
12		LEAD	2	78.1000	120.0000	99.0500	20.9500	96.8090
15		MERCURY	2	1.1000	1.4000	1.2500	0.1500	1.2409
16		NICKEL	2	24.8000	36.4000	30.6000	5.8000	30.0452
19		SILVER	2	2.3000	2.7000	2.5000	0.2000	2.4919
24		ZINC	2	110.0000	130.0000	120.0000	10.0000	119.5826

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH04 SEDIMENTS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
3		ARSENIC	2	6.4000	6.7000	6.5500	0.1500	6.5482
5		BERYLLIUM	2	2.1000	2.2000	2.1500	0.0500	2.1494
8		CHROMIUM	2	25.5000	27.5000	26.5000	1.0000	26.4811
10		COPPER	2	19.3000	21.4000	20.3500	1.0500	20.3228
12		LEAD	1	29.9000	29.9000	29.9000	0.0000	29.9000
15		MERCURY	2	0.5000	0.5000	0.5000	0.0000	0.5000
16		NICKEL	2	32.5000	34.1000	33.3000	0.8000	33.2903
24		ZINC	2	59.2000	62.1000	60.6500	1.4500	60.6326

8

PHASE I SURFACE WATER STATISTICAL ANALYSIS - SITE BY SITE

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH03 SURFACE WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
2		ANTIMONY	1	66.3000	66.3000	66.3000	0.0000	66.3000
3		ARSENIC	1	74.6000	74.6000	74.6000	0.0000	74.6000
19		SILVER	1	7.6000	7.6000	7.6000	0.0000	7.6000
24		ZINC	1	128.0000	128.0000	128.0000	0.0000	128.0000
25		CYANIDE	2	17.5000	80.0000	48.7500	31.2500	37.4165
		CHLORIDE	2	147.0000	150.0000	148.5000	1.5000	148.4924
		CYANIDE UG/L	2	17.5000	80.3000	48.9000	31.4000	37.4866
		NITRITE (as N)	2	0.3000	0.4000	0.3500	0.0500	0.3464
		SULFATE	2	47.9000	53.6000	50.7500	2.8500	50.6699
		TDS	2	431.0000	460.0000	445.5000	14.5000	445.2639
		FLUORIDE	2	2.2000	2.3000	2.2500	0.0500	2.2494
		BROMIDE	2	0.5700	0.7400	0.6550	0.0850	0.6494
		PHOSPHATE, ORTHO	2	15.0000	16.0000	15.5000	0.5000	15.4919
		PHOSPHATE, TOTAL UG/L	2	4810.0000	4980.0000	4895.0000	85.0000	4894.2619

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH04 SURFACE WATER

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
67B	85-68-7	BUTYL BENZYL PHTHALATE	1	6.0000	6.0000	6.0000	0.0000	6.0000
2		ANTIMONY	1	55.5000	55.5000	55.5000	0.0000	55.5000
		CHLORIDE	2	78.1000	160.0000	119.0500	40.9500	111.7855
		NITRATE (as N)	1	0.8100	0.8100	0.8100	0.0000	0.8100
		SULFATE	2	49.2000	72.8000	61.0000	11.8000	59.8478
		TDS	2	437.0000	632.0000	534.5000	97.5000	525.5321
		FLUORIDE	2	1.1000	1.4000	1.2500	0.1500	1.2409
		BROMIDE	2	0.9100	2.9000	1.9050	0.9950	1.6244
		PHOSPHATE, TOTAL UG/L	2	34.8000	57.6000	46.2000	11.4000	44.7714

53

PHASE I BLANK STATISTICAL ANALYSIS

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH02 TRIP BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH04 RINSATE BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH00 FIELD BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
	67-64-1	ACETONE	3	15.0000	860.0000	408.3333	347.4271	165.2795
86V	108-88-3	TOLUENE	4	3.0000	57.0000	25.7500	23.5306	11.9686
87V	79-01-6	TRICHLOROETHENE	1	2.0000	2.0000	2.0000	0.0000	2.0000
23V	67-66-3	CHLOROFORM	1	3.0000	3.0000	3.0000	0.0000	3.0000
44V	75-09-2	METHYLENE CHLORIDE	6	5.0000	200.0000	83.3333	79.4474	32.0900
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	10.0000	10.0000	10.0000	0.0000	10.0000
		TDS	1	15.0000	15.0000	15.0000	0.0000	15.0000
		GAMMA EMITTERS CS 137 (pCi/g)	1	4.9000	4.9000	4.9000	0.0000	4.9000
		GROSS BETA (pCi/g)	1	47.0000	47.0000	47.0000	0.0000	47.0000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH00 RINSATE BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
	67-64-1	ACETONE	4	11.0000	330.0000	113.7500	126.7012	57.5601
4V	71-43-2	BENZENE	1	2.0000	2.0000	2.0000	0.0000	2.0000
86V	108-88-3	TOLUENE	2	3.0000	5.0000	4.0000	1.0000	3.8729
23V	67-66-3	CHLOROFORM	3	1.0000	4.0000	2.3333	1.2472	2.0000
44V	75-09-2	METHYLENE CHLORIDE	6	6.0000	120.0000	44.8333	42.9318	26.7093
46V	74-83-9	BROMOMETHANE	1	2.0000	2.0000	2.0000	0.0000	2.0000
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	2	6.0000	100.0000	53.0000	47.0000	24.4948
67B	85-68-7	BUTYL BENZYL PHTHALATE	1	2.0000	2.0000	2.0000	0.0000	2.0000
6		CADMIUM	1	29.0000	29.0000	29.0000	0.0000	29.0000
8		CHROMIUM	1	23.0000	23.0000	23.0000	0.0000	23.0000
18		SELENIUM	1	2.6400	2.6400	2.6400	0.0000	2.6400
24		ZINC	1	1761.0000	1761.0000	1761.0000	0.0000	1761.0000
		TDS	1	8.0000	8.0000	8.0000	0.0000	8.0000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE I) SH00 TRIP BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
	67-64-1	ACETONE	2	11.0000	13.0000	12.0000	1.0000	11.9582
44V	75-09-2	METHYLENE CHLORIDE	5	4.0000	10.0000	6.8000	2.3152	6.4074

PHASE II BLANK STATISTICAL ANALYSIS

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH00 FIELD BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
	67-64-1	ACETONE	1	4.0000	4.0000	4.0000	0.0000	4.0000
86V	108-88-3	TOLUENE	1	1.0000	1.0000	1.0000	0.0000	1.0000
44V	75-09-2	METHYLENE CHLORIDE	1	4.0000	4.0000	4.0000	0.0000	4.0000
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	18.0000	18.0000	18.0000	0.0000	18.0000
24		ZINC	1	15.0000	15.0000	15.0000	0.0000	15.0000

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH00 RINSATE BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
	67-64-1	ACETONE	3	6.0000	17.0000	10.3333	4.7842	9.3446
86V	108-88-3	TOLUENE	1	1.0000	1.0000	1.0000	0.0000	1.0000
23V	67-66-3	CHLOROFORM	1	2.0000	2.0000	2.0000	0.0000	2.0000
44V	75-09-2	METHYLENE CHLORIDE	3	1.0000	5.0000	3.6667	1.8856	2.9240
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1	180.0000	180.0000	180.0000	0.0000	180.0000
10		COPPER	1	13.0000	13.0000	13.0000	0.0000	13.0000
12		LEAD	1	47.0000	47.0000	47.0000	0.0000	47.0000
24		ZINC	2	18.0000	21.0000	19.5000	1.5000	19.4422
		RADIUM 226 (pCi/L)	1	0.4000	0.4000	0.4000	0.0000	0.4000

52

STATISTICAL ANALYSIS FOR SAMPLE TYPE: (PHASE II) SH00 TRIP BLANKS

PP NO	CAS NO	COMPOUND	# OF DETECTS / # OF SAMPLES	MINIMUM DETECTED CONC.	MAXIMUM DETECTED CONC.	AVERAGE	STD. DEVIATION	GEOMETRIC MEAN
	67-64-1	ACETONE	4	3.0000	17.0000	9.2500	5.1174	7.7297
86V	108-88-3	TOLUENE	1	1.0000	1.0000	1.0000	0.0000	1.0000
23V	67-66-3	CHLOROFORM	1	3.0000	3.0000	3.0000	0.0000	3.0000
44V	75-09-2	METHYLENE CHLORIDE	4	5.0000	11.0000	8.5000	2.2913	8.1444

BASE BACKGROUND DATA

SHEPPARD AFB (PHASE I) SH12 SUBSURFACE SOIL

SAMPLE NUMBER:	SH12-SU-BB01-A	SH12-SU-BB01-B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

65

SHEPPARD AFB (PHASE I) SH12 SUBSURFACE SOIL

SAMPLE NUMBER:			SH12-SU-BB01-A	SH12-SU-BB01-B
DILUTION FACTOR:			1	1
DESCRIPTION:				
UNITS:			UG/KG	UG/KG
DATE SAMPLED:			12/07/88	12/07/88
*** BASE/NEUTRALS ***				
PP	CAS NO	COMPOUND		
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	80	

66

SHEPPARD AFB (PHASE I) SH12 SUBSURFACE SOIL

SAMPLE NUMBER:	SH12-SU-BB01-A	SH12-SU-BB01-B
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

67

SHEPPARD AFB (PHASE I) SH12 SUBSURFACE SOIL

SAMPLE NUMBER:	SH12-SU-BB01-A	SH12-SU-BB01-B
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH12 SUBSURFACE SOIL

SAMPLE NUMBER:			SH12-SU-BB01-A	SH12-SU-BB01-B
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:			MG/KG	MG/KG
DATE SAMPLED:			12/07/88	12/07/88
*** INORGANICS ***				
PP	CAS NO	COMPOUND		
3		ARSENIC	J 2	J 1.7
8		CHROMIUM	J 9	J 10.9
10		COPPER	J 20	J 32.1
12		LEAD	5.6	6
15		MERCURY	0.4	0.4
16		NICKEL	27.7	13.4
24		ZINC	27.4	36.2

SHEPPARD AFB (PHASE I) SH12 SUBSURFACE SOIL

SAMPLE NUMBER:	SH12-SU-BB01-A	SH12-SU-BB01-B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	12/07/88	12/07/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND		
		CATION EXCHANGE CAPACITY MEQ/100G	10.6	NA
		GAMMA EMITTERS TH 232 (pCi/g)	0.8±0.1	0.9±0.1
		GAMMA EMITTERS RA 228 (pCi/g)	1.0±0.1	0.7±0.1
		GAMMA EMITTERS RA 226 (pCi/g)	0.8±0.1	0.6±0.1

SHEPPARD AFB (PHASE I) SHBB GROUNDWATER

SAMPLE NUMBER:	SHBB-GW-BB01-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SHBB GROUNDWATER

SAMPLE NUMBER:	SHBB-GW-BB01-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SHBB GROUNDWATER

SAMPLE NUMBER:	SHBB-GW-BB01-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SHBB GROUNDWATER

SAMPLE NUMBER:	SHBB-GW-BB01-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SHBB GROUNDWATER

SAMPLE NUMBER:	SHBB-GW-BB01-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	
18		SELENIUM	4.17

SHEPPARD AFB (PHASE I) SHBB GROUNDWATER

SAMPLE NUMBER:	SHBB-GW-BB01-A
DILUTION FACTOR:	
DESCRIPTION:	-
UNITS:	MG/L
DATE SAMPLED:	12/18/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	
		CHLORIDE	90.7
		NITRATE (as N)	65.9
		SULFATE	62.4
		TDS	796
		FLUORIDE	0.82
		BROMIDE	0.5
		GAMMA EMITTERS CS 137 (pCi/g)	-
		RADIUM 228 (pCi/g)	J 1.8±0.7

746

PHASE I DATA - GROUNDWATER

77

SHEPPARD AFB (PHASE I) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201-A	SH02-GW-MW202-A
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/20/88	12/20/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201-A	SH02-GW-MW202-A
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/20/88	12/20/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

19

SHEPPARD AFB (PHASE I) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201-A	SH02-GW-MW202-A
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/20/88	12/20/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201-A	SH02-GW-MW202-A
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/20/88	12/20/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

81

SHEPPARD AFB (PHASE I) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201-A	SH02-GW-MW202-A
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/20/88	12/20/88

*** INORGANICS ***

PP	CAS NO	COMPOUND		
18		SELENIUM	1.6	

98

SHEPPARD AFB (PHASE I) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201-A	SH02-GW-MW202-A
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	MG/L	MG/L
DATE SAMPLED:	12/20/88	12/20/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH02-GW-MW201-A	SH02-GW-MW202-A
		CHLORIDE	7332	7335
		NITRATE (as N)	58.6	
		SULFATE	1197	2885
		TDS	11788	18542
		BROMIDE	15.0	2.5
		GAMMA EMITTERS CS 137 (pCi/g)	NA	NA
		GROSS ALPHA (pCi/g)	NA	NA
		GROSS BETA (pCi/g)	NA	NA
		RADIUM 226 (pCi/g)	NA	NA
		RADIUM 228 (pCi/g)	NA	NA

83

SHEPPARD AFB (PHASE I) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301-A	SH03-GW-MW301-A	SH03-GW-MW302-A	SH03-GW-MW302-A	SH03-GW-MW302-X
DILUTION FACTOR:	1.0	1	1	1.0	1.0
DESCRIPTION:					DUPLICATE
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	12/18/88	12/18/88	11/15/88	11/15/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

81

SHEPPARD AFB (PHASE I) SH03 GROUNDWATER

SAMPLE NUMBER:		SH03-GW-MW301-A	SH03-GW-MW301-A	SH03-GW-MW302-A	SH03-GW-MW302-A	SH03-GW-MW302-X
DILUTION FACTOR:			1	1		
DESCRIPTION:						DUPLICATE
UNITS:		UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:		11/17/88	12/18/88	12/18/88	11/15/88	11/15/88
*** BASE/NEUTRALS ***						
PP / CAS NO	COMPOUND					
66B 117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE			J 3		

SHEPPARD AFB (PHASE I) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301-A	SH03-GW-MW301-A	SH03-GW-MW302-A	SH03-GW-MW302-A	SH03-GW-MW302-X
DILUTION FACTOR:		1	1		
DESCRIPTION:					DUPLICATE
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	12/18/88	12/18/88	11/15/88	11/15/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

8

SHEPPARD AFB (PHASE I) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301-A	SH03-GW-MW301-A	SH03-GW-MW302-A	SH03-GW-MW302-A	SH03-GW-MW302-X
DILUTION FACTOR:	1.0	1	1	1.0	1.0
DESCRIPTION:					DUPLICATE
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	12/18/88	12/18/88	11/15/88	11/15/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

3

SHEPPARD AFB (PHASE I) SH03 GROUNDWATER

SAMPLE NUMBER:			SH03-GW-MW301-A	SH03-GW-MW301-A	SH03-GW-MW302-A	SH03-GW-MW302-A	SH03-GW-MW302-X
DILUTION FACTOR:							
DESCRIPTION:							DUPLICATE
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			11/17/88	12/18/88	12/18/88	11/15/88	11/15/88
*** INORGANICS ***							
PP	CAS NO	COMPOUND					
10		COPPER			J 164		
18		SELENIUM		5.82			
24		ZINC				102	104

SHEPPARD AFB (PHASE I) SH03 GROUNDWATER

SAMPLE NUMBER:		SH03-GW-MW301-A	SH03-GW-MW301-A	SH03-GW-MW302-A	SH03-GW-MW302-A	SH03-GW-MW302-X
DILUTION FACTOR:						
DESCRIPTION:						DUPLICATE
UNITS:			MG/L			
DATE SAMPLED:		11/17/88	12/18/88	12/18/88	11/15/88	11/15/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND					
		CHLORIDE		617.0			
		NITRATE (as N)		0.26			
		SULFATE		291.0			
		TDS		2914			
		FLUORIDE		2.1			
		BROMIDE		2.9			
		GAMMA EMITTERS CS 137 (pCi/g)	NA	NA	NA	NA	NA
		GROSS ALPHA (pCi/g)	NA	NA	NA	NA	NA
		GROSS BETA (pCi/g)	NA	NA	NA	NA	NA
		RADIUM 226 (pCi/g)	NA	NA	NA	NA	NA
		RADIUM 228 (pCi/g)	NA	NA	NA	NA	NA

SHEPPARD AFB (PHASE I) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
DILUTION FACTOR:	1.0	1.0	1	1
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	12/18/88	12/18/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
DILUTION FACTOR:			1	1
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	12/18/88	12/18/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
DILUTION FACTOR:			1	1
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	12/18/88	12/18/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

92

SHEPPARD AFB (PHASE I) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
DILUTION FACTOR:	1.0	1.0	1	1
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	12/18/88	12/18/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 GROUNDWATER

	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
SAMPLE NUMBER:	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	12/18/88	12/18/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
3		ARSENIC		7		
12		LEAD	J 2			
18		SELENIUM	7	17	13.5	

SHEPPARD AFB (PHASE I) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	MG/L	MG/L	MG/L	MG/L
DATE SAMPLED:	11/19/88	11/19/88	12/18/88	12/18/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH04-GW-MW004-A	SH04-GW-MW007-A	SH04-GW-MW402-A	SH04-GW-MW403-A
		CHLORIDE	3151.0	3149.0	3650	2529
		CYANIDE UG/L				J 6.63
		NITRATE (as N)	9.7	1.3	4.7	3.7
		SULFATE	954.0	1594.0	1069	1608
		TDS		1123	10268	14408
		FLUORIDE			5.2	6.9
		BROMIDE	15.8	14.1	17.7	23.1
		PHOSPHATE, TOTAL UG/L	241.0	279.0		
		GAMMA EMITTERS CS 137 (pCi/g)	NA	NA	NA	NA
		GROSS ALPHA (pCi/g)	NA	NA	NA	NA
		GROSS BETA (pCi/g)	NA	NA	NA	NA
		RADIUM 226 (pCi/g)	NA	NA	NA	NA
		RADIUM 228 (pCi/g)	NA	NA	NA	NA

95

SHEPPARD AFB (PHASE 1) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1	1	1
DESCRIPTION:							
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	11/19/88	11/17/88	11/19/88	12/19/88	12/19/88	12/19/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE 1) SH05 GROUNDWATER

	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
SAMPLE NUMBER:	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
DILUTION FACTOR:					1	1	1
DESCRIPTION:							
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	11/19/88	11/17/88	11/19/88	12/19/88	12/19/88	12/19/88
*** BASE/NEUTRALS ***							
PP CAS NO COMPOUND							
66B 117-81-7 BIS(2-ETHYLHEXYL)PHTHALATE							110
69B 117-84-0 DI-N-OCTYL PHTHALATE							6J

SHEPPARD AFB (PHASE 1) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
DILUTION FACTOR:					1	1	1
DESCRIPTION:							
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	11/19/88	11/17/88	11/19/88	12/19/88	12/19/88	12/19/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

D
R

SHEPPARD AFB (PHASE 1) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1	1	1
DESCRIPTION:							
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	11/19/88	11/17/88	11/19/88	12/19/88	12/19/88	12/19/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE 1) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/17/88	11/19/88	11/17/88	11/19/88	12/18/88	12/19/88	12/19/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
3		ARSENIC	4						
6		CADMIUM		J 8					
8		CHROMIUM				12			
16		NICKEL			22	248			43.6

8

SHEPPARD AFB (PHASE 1) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
DATE SAMPLED:	11/17/88	11/19/88	11/17/88	11/19/88	12/18/88	12/19/88	12/19/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH05-GW-MW011-A	SH05-GW-MW012-A	SH05-GW-MW013-A	SH05-GW-MW014-A	SH05-GW-MW501-A	SH05-GW-MW502-A	SH05-GW-MW503-A
		CHLORIDE	43.9	184.0	346.0	315.0	262.0	242.0	591.0
		NITRATE (as N)	8.7	72.8	38.7	21.1	47.1	10.8	50.7
		SULFATE	33.7	146.0	122.0	196.0	152.0	130.0	237.0
		TDS	330	11343	775	1445	949	1105	1418
		FLUORIDE					0.73	0.77	0.87
		BROMIDE	0.55	1.2	1.3	1.8	0.85	1.7	1.5
		PHOSPHATE, TOTAL UG/L	118.0	66.8	456.0	44.1			
		GAMMA EMITTERS CS 137 (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		GROSS ALPHA (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		GROSS BETA (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		RADIUM 226 (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		RADIUM 228 (pCi/g)	NA	NA	NA	NA	NA	NA	NA

SHEPPARD AFB (PHASE I) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW008-A	SH07-GW-MW009-A	SH07-GW-MW010-A	SH07-GW-MW701-A	SH07-GW-MW702-A
DILUTION FACTOR:	1.0	1.0	1.0	1	1
DESCRIPTION:					
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	11/19/88	12/20/88	12/20/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW008-A	SH07-GW-MW009-A	SH07-GW-MW010-A	SH07-GW-MW701-A	SH07-GW-MW702-A
DILUTION FACTOR:				1	1
DESCRIPTION:					
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	11/19/88	12/20/88	12/20/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW008-A	SH07-GW-MW009-A	SH07-GW-MW010-A	SH07-GW-MW701-A	SH07-GW-MW702-A
DILUTION FACTOR:				1	1
DESCRIPTION:					
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	11/19/88	12/20/88	12/20/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW008-A	SH07-GW-MW009-A	SH07-GW-MW010-A	SH07-GW-MW701-A	SH07-GW-MW702-A
DILUTION FACTOR:	1.0	1.0	1.0	1	1
DESCRIPTION:					
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	11/19/88	12/20/88	12/20/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH07 GROUNDWATER

			SAMPLE NUMBER:	SH07-GW-MW008-A	SH07-GW-MW009-A	SH07-GW-MW010-A	SH07-GW-MW701-A	SH07-GW-MW702-A
			DILUTION FACTOR:					
			DESCRIPTION:					
			UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
			DATE SAMPLED:	11/19/88	11/19/88	11/19/88	12/20/88	12/20/88
*** INORGANICS ***								
PP	CAS NO	COMPOUND						
3		ARSENIC			5			
10		COPPER			60			
12		LEAD		J 13				
16		NICKEL		168			38.2	
18		SELENIUM		3				

SHEPPARD AFB (PHASE I) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW008-A	SH07-GW-MW009-A	SH07-GW-MW010-A	SH07-GW-MW701-A	SH07-GW-MW702-A
DILUTION FACTOR:					
DESCRIPTION:					
UNITS:					
DATE SAMPLED:	11/19/88	11/19/88	11/19/88	12/20/88	12/20/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND					
		GAMMA EMITTERS CS 137 (pCi/g)	NA	NA	NA	NA	NA
		GROSS ALPHA (pCi/g)	NA	NA	NA	NA	NA
		GROSS BETA (pCi/g)	NA	NA	NA	NA	NA
		RADIUM 226 (pCi/g)	NA	NA	NA	NA	NA
		RADIUM 228 (pCi/g)	NA	NA	NA	NA	NA

107

SHEPPARD AFB (PHASE I) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/19/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/19/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/19/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/19/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/19/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	
3		ARSENIC	4.18
18		SELENIUM	2.63

112

SHEPPARD AFB (PHASE I) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	12/19/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	
		GAMMA EMITTERS CS 137 (pCi/g)	NA
		GROSS ALPHA (pCi/g)	NA
		GROSS BETA (pCi/g)	NA
		RADIUM 226 (pCi/g)	NA
		RADIUM 228 (pCi/g)	NA

SHEPPARD AFB (PHASE I) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

II

SHEPPARD AFB (PHASE I) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

115

SHEPPARD AFB (PHASE I) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

116

SHEPPARD AFB (PHASE I) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

3

SHEPPARD AFB (PHASE I) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	12/18/88

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	MG/L
DATE SAMPLED:	12/18/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	
		CHLORIDE	7370
		NITRATE (as N)	2.7
		SULFATE	2254
		TDS	14635
		FLUORIDE	6.7
		BROMIDE	21.6
		GAMMA EMITTERS CS 137 (pCi/g)	-
		GROSS ALPHA (pCi/g)	*
		GROSS BETA (pCi/g)	*
		RADIUM 226 (pCi/g)	2.4±0.1
		RADIUM 228 (pCi/g)	J 3.4±0.6

619

PHASE II DATA - GROUNDWATER

SHEPPARD AFB (PHASE II) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:			DUPLICATE	
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/18/89	07/18/89	07/18/89	07/18/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

ψ

SHEPPARD AFB (PHASE II) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:			DUPLICATE	
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/18/89	07/18/89	07/18/89	07/18/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
70B	84-66-2	DIETHYL PHTHALATE		2J	2J	2J
67B	85-68-7	BUTYL BENZYL PHTHALATE			12	

792

SHEPPARD AFB (PHASE II) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:			DUPLICATE	
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/18/89	07/18/89	07/18/89	07/18/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

23

SHEPPARD AFB (PHASE II) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:			DUPLICATE	
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/18/89	07/18/89	07/18/89	07/18/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH02 GROUNDWATER

SAMPLE NUMBER:		SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
DILUTION FACTOR:					
DESCRIPTION:				DUPLICATE	
UNITS:		UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:		07/18/89	07/18/89	07/18/89	07/18/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
3		ARSENIC	11.5	74.1J	109J	[4.2]
8		CHROMIUM				45.0
18		SELENIUM	[2.5]J			

795

SHEPPARD AFB (PHASE II) SH02 GROUNDWATER

SAMPLE NUMBER:	SH02-GW-MW201B	SH02-GW-MW202B	SH02-GW-MW202BD	SH02-GW-MW204A
DILUTION FACTOR:				
DESCRIPTION:			DUPLICATE	
UNITS:				
DATE SAMPLED:	07/18/89	07/18/89	07/18/89	07/18/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

126

SHEPPARD AFB (PHASE II) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
DILUTION FACTOR:	NA	1.0	NA	NA	1.0
DESCRIPTION:					
UNITS:		UG/L			UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/12/89	07/12/89	07/17/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

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SHEPPARD AFB (PHASE II) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
DILUTION FACTOR:	NA	1.0	NA	NA	1.0
DESCRIPTION:					
UNITS:		UG/L			UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/12/89	07/12/89	07/17/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
DILUTION FACTOR:	NA	1.0	NA	NA	1.0
DESCRIPTION:					
UNITS:		UG/L			UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/12/89	07/12/89	07/17/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

129

SHEPPARD AFB (PHASE II) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
DILUTION FACTOR:	NA	1.0	NA	NA	1.0
DESCRIPTION:					
UNITS:		UG/L			UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/12/89	07/12/89	07/17/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH03 GROUNDWATER

	SH03-GW-MW30-1B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
SAMPLE NUMBER:	SH03-GW-MW30-1B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
DILUTION FACTOR:	NA		NA	NA	
DESCRIPTION:					
UNITS:		UG/L			UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/12/89	07/12/89	07/17/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH03-GW-MW30-1B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
3		ARSENIC		20.3			[5.9]
16		NICKEL		[26.0]			

SHEPPARD AFB (PHASE II) SH03 GROUNDWATER

SAMPLE NUMBER:	SH03-GW-MW301B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
DILUTION FACTOR:					
DESCRIPTION:				DUPLICATE	
UNITS:					
DATE SAMPLED:	07/14/89	07/17/89	07/12/89	07/12/89	07/17/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH03-GW-MW301B	SH03-GW-MW301C	SH03-GW-MW302B	SH03-GW-MW302BD	SH03-GW-MW302C
		RADIUM 226 (pCi/L)			3.5±0.4J		
		RADIUM 228 (pCi/L)	2.2±0.9J		4.4±1.2J	3.0±1.4J	

132

SHEPPARD AFB (PHASE II) SH04 GROUNDWATER

			SH04-GW-MW007B	SH04-GW-MW402B
SAMPLE NUMBER:			SH04-GW-MW007B	SH04-GW-MW402B
DILUTION FACTOR:			NA	1.0
DESCRIPTION:				
UNITS:				UG/L
DATE SAMPLED:			07/12/89	07/19/89
*** VOLATILES ***				
PP	CAS NO	COMPOUND		
4V	71-43-2	BENZENE		5

SHEPPARD AFB (PHASE II) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW007B	SH04-GW-MW402B
DILUTION FACTOR:	NA	1.0
DESCRIPTION:		
UNITS:		UG/L
DATE SAMPLED:	07/12/89	07/19/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW007B	SH04-GW-MW402B
DILUTION FACTOR:	NA	1.0
DESCRIPTION:		
UNITS:		UG/L
DATE SAMPLED:	07/12/89	07/19/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

135

SHEPPARD AFB (PHASE II) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW007B	SH04-GW-MW402B
DILUTION FACTOR:	NA	1.0
DESCRIPTION:		
UNITS:		UG/L
DATE SAMPLED:	07/12/89	07/19/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

136

SHEPPARD AFB (PHASE II) SH04 GROUNDWATER

		SH04-GW-MW007B	SH04-GW-MW402B
SAMPLE NUMBER:		SH04-GW-MW007B	SH04-GW-MW402B
DILUTION FACTOR:		NA	
DESCRIPTION:			
UNITS:			UG/L
DATE SAMPLED:		07/12/89	07/19/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH04-GW-MW007B	SH04-GW-MW402B
3		ARSENIC		10.8
8		CHROMIUM		[7.0]
18		SELENIUM		5.8J

SHEPPARD AFB (PHASE II) SH04 GROUNDWATER

SAMPLE NUMBER:	SH04-GW-MW007B	SH04-GW-MW402B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	07/12/89	07/19/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW502B	SH05-GW-MW503B
DILUTION FACTOR:	1.0	1.0
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/14/89

*** VOLATILES ***

PP	CAS NO	COMPOUND	SH05-GW-MW502B	SH05-GW-MW503B
87V	79-01-6	TRICHLOROETHENE	3J	

139

SHEPPARD AFB (PHASE II) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW502B	SH05-GW-MW503B
DILUTION FACTOR:	1.0	1.0
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/14/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

I
O

SHEPPARD AFB (PHASE II) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW502B	SH05-GW-MW503B
DILUTION FACTOR:	1.0	1.0
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/14/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

I

SHEPPARD AFB (PHASE II) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW502B	SH05-GW-MW503B
DILUTION FACTOR:	1.0	1.0
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/14/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

I-82

SHEPPARD AFB (PHASE II) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW502B	SH05-GW-MW503B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/14/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH05-GW-MW502B	SH05-GW-MW503B
8		CHROMIUM	105	1850
16		NICKEL	44.0	161

I3

SHEPPARD AFB (PHASE II) SH05 GROUNDWATER

SAMPLE NUMBER:	SH05-GW-MW502B	SH05-GW-MW503B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	07/14/89	07/14/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

II

SHEPPARD AFB (PHASE II) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW701B
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	07/14/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

I-5

SHEPPARD AFB (PHASE II) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW701B
DILUTION FACTOR:	1.0
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	07/14/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

I-6

SHEPPARD AFB (PHASE II) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW701B
DILUTION FACTOR:	1.0
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	07/14/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

I
J

SHEPPARD AFB (PHASE II) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW701B
DILUTION FACTOR:	1.0
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	07/14/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW701B
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/L
DATE SAMPLED:	07/14/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	
8		CHROMIUM	500
16		NICKEL	372

SHEPPARD AFB (PHASE II) SH07 GROUNDWATER

SAMPLE NUMBER:	SH07-GW-MW701B
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	07/14/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
DILUTION FACTOR:	1.0	1.0	NA	1.0
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/17/89	07/19/89	07/18/89	07/19/89

*** VOLATILES ***

PP	CAS NO	COMPOUND	SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
4V	71-43-2	BENZENE	2J			1J
10V	107-06-2	1,2-DICHLOROETHANE				1J
87V	79-01-6	TRICHLOROETHENE		1J		

SHEPPARD AFB (PHASE II) SH08 GROUNDWATER

SAMPLE NUMBER:			SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
DILUTION FACTOR:			1.0	1.0		1.0
DESCRIPTION:						
UNITS:			UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			07/17/89	07/19/89	07/18/89	07/19/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
68B	84-74-2	DI-N-BUTYL PHTHALATE				1J
70B	84-66-2	DIETHYL PHTHALATE				0.7J

SHEPPARD AFB (PHASE II) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
DILUTION FACTOR:	1.0	1.0		1.0
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/17/89	07/19/89	07/18/89	07/19/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH08 GROUNDWATER

SAMPLE NUMBER:			SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
DILUTION FACTOR:			1.0	1.0	10.0	1.0
DESCRIPTION:						
UNITS:			UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			07/17/89	07/19/89	07/18/89	07/19/89
*** PESTICIDES ***						
PP	CAS NO	COMPOUND				
	319-84-6	ALPHA-CHLORDANE			2.5	2.7
103P	319-85-7	BETA-BHC	0.21			
100P	76-44-8	HEPTACHLOR				0.15
	72-54-8	4,4'-DDD				0.42
91P	57-74-9	GAMMA CHLORDANE			1.8	2.0

SHEPPARD AFB (PHASE II) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
DILUTION FACTOR:			NA	
DESCRIPTION:				
UNITS:	UG/L	UG/L		UG/L
DATE SAMPLED:	07/17/89	07/19/89	07/18/89	07/19/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
3		ARSENIC	17.7	17.2		13.1
16		NICKEL		[16.0]		
18		SELENIUM		5.7J		

155

SHEPPARD AFB (PHASE II) SH08 GROUNDWATER

SAMPLE NUMBER:	SH08-GW-MW801B	SH08-GW-MW802A	SH08-GW-MW802BD	SH08-GW-MW803A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	07/17/89	07/19/89	07/18/89	07/19/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

156

SHEPPARD AFB (PHASE II) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111B
DILUTION FACTOR:	NA
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	07/12/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

157

SHEPPARD AFB (PHASE II) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111B
DILUTION FACTOR:	NA
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	07/12/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

158

SHEPPARD AFB (PHASE II) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111B
DILUTION FACTOR:	NA
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	07/12/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

159

SHEPPARD AFB (PHASE II) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111B
DILUTION FACTOR:	NA
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	07/12/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH11 GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111B
DILUTION FACTOR:	NA
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	07/12/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

61

SHEPPARD AFB (PHASE II) SHII GROUNDWATER

SAMPLE NUMBER:	SH11-GW-MW111B
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	07/12/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	
		RADIUM 226 (pCi/L)	2.3±0.3J
		RADIUM 228 (pCi/L)	2.2±1.3J

162

SHEPPARD AFB (PHASE II) SH13 GROUNDWATER

	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
SAMPLE NUMBER:	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/19/89	07/19/89	07/19/89	07/19/89

*** VOLATILES ***

PP	CAS NO	COMPOUND	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
4V	71-43-2	BENZENE			1J	

SHEPPARD AFB (PHASE II) SH13 GROUNDWATER

SAMPLE NUMBER:	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
DILUTION FACTOR:	NA	NA	NA	NA
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/19/89	07/19/89	07/19/89	07/19/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH13 GROUNDWATER

SAMPLE NUMBER:	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
DILUTION FACTOR:	NA	NA	NA	NA
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/19/89	07/19/89	07/19/89	07/19/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

165

SHEPPARD AFB (PHASE II) SH13 GROUNDWATER

SAMPLE NUMBER:	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
DILUTION FACTOR:	NA	NA	NA	NA
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/19/89	07/19/89	07/19/89	07/19/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH13 GROUNDWATER

SAMPLE NUMBER:	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/19/89	07/19/89	07/19/89	07/19/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

6

SHEPPARD AFB (PHASE II) SH13 GROUNDWATER

SAMPLE NUMBER:	SH13-GW-MW131A	SH13-GW-MW132A	SH13-GW-MW133A	SH13-GW-MW134A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	07/19/89	07/19/89	07/19/89	07/19/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

PHASE I DATA - SURFACE SOILS

SHEPPARD AFB (PHASE I) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
DILUTION FACTOR:	1	1	1
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	60	J 70	100

3

SHEPPARD AFB (PHASE I) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
DILUTION FACTOR:	1	1	1
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
DILUTION FACTOR:	1	1	1
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
3		ARSENIC	J 3.5	J 1.7	J 2.9
8		CHROMIUM	J 15.1	J 7.5	J 63.5
10		COPPER	J 38.2	J 15.4	J 17.1
12		LEAD	21.9	17.5	0.92
15		MERCURY	0.3	0.3	0.3
16		NICKEL	12.2		
24		ZINC	35.5	22.1	26.3

H-3

SHEPPARD AFB (PHASE I) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-001-1	SH02-SS-002-1	SH02-SS-003-1
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:			
DATE SAMPLED:	12/08/88	12/08/88	12/08/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE 1) SH03 SURFACE SOIL

SAMPLE NUMBER:	SH03-SS-001-1
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/07/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH03 SURFACE SOIL

SAMPLE NUMBER:	SH03-SS-001-1
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/07/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH03 SURFACE SOIL

SAMPLE NUMBER:	SH03-SS-001-1
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/07/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH03 SURFACE SOIL

SAMPLE NUMBER:	SH03-SS-001-1
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/07/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH03 SURFACE SOIL

SAMPLE NUMBER:	SH03-SS-001-1
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	MG/KG
DATE SAMPLED:	12/07/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	
3		ARSENIC	1.9
5		BERYLLIUM	0.9
8		CHROMIUM	35.7
10		COPPER	J 26.2
12		LEAD	31.8
15		MERCURY	0.3
16		NICKEL	30.5
24		ZINC	J 60.3

SHEPPARD AFB (PHASE I) SH03 SURFACE SOIL

SAMPLE NUMBER:	SH03-SS-001-1
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	12/07/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SURFACE SOILS

SAMPLE NUMBER:	SH04-SS-001-1	SH04-SS-002-1
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

182

SHEPPARD AFB (PHASE I) SH04 SURFACE SOILS

SAMPLE NUMBER:	SH04-SS-001-1	SH04-SS-002-1
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	SH04-SS-001-1	SH04-SS-002-1
69B	117-84-0	DI-N-OCTYL PHTHALATE		60

SHEPPARD AFB (PHASE 1) SH04 SURFACE SOILS

SAMPLE NUMBER:	SH04-SS-001-1	SH04-SS-002-1
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SURFACE SOILS

SAMPLE NUMBER:	SH04-SS-001-1	SH04-SS-002-1
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SURFACE SOILS

SAMPLE NUMBER:			SH04-SS-001-1	SH04-SS-002-1
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:			MG/KG	MG/KG
DATE SAMPLED:			12/08/88	12/08/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH04-SS-001-1	SH04-SS-002-1
3		ARSENIC	2.4	3.9
5		BERYLLIUM	1.2	1.7
8		CHROMIUM	12.7	17.9
10		COPPER	5.5	5.9
12		LEAD	J 16.6	J 13.8
15		MERCURY	0.4	0.2
16		NICKEL	12.6	19.5
24		ZINC	J 25.4	J 29.8

SHEPPARD AFB (PHASE I) SH04 SURFACE SOILS

SAMPLE NUMBER:	SH04-SS-001-1	SH04-SS-002-1
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	12/08/88	12/08/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

187

SHEPPARD AFB (PHASE I) SH06 SURFACE SOILS

SAMPLE NUMBER:	SH06-SS-SS601-A	SH06-SS-SS602-A	SH06-SS-SS603-A	SH06-SS-SS604-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/11/88	11/11/88	11/11/88	11/11/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH06 SURFACE SOILS

SAMPLE NUMBER:	SH06-SS-SS601-A	SH06-SS-SS602-A	SH06-SS-SS603-A	SH06-SS-SS604-A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/11/88	11/11/88	11/11/88	11/11/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH06 SURFACE SOILS

SAMPLE NUMBER:	SH06-SS-SS601-A	SH06-SS-SS602-A	SH06-SS-SS603-A	SH06-SS-SS604-A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/11/88	11/11/88	11/11/88	11/11/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH06 SURFACE SOILS

SAMPLE NUMBER:	SH06-SS-SS601-A	SH06-SS-SS602-A	SH06-SS-SS603-A	SH06-SS-SS604-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/11/88	11/11/88	11/11/88	11/11/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH06 SURFACE SOILS

SAMPLE NUMBER:	SH06-SS-SS601-A	SH06-SS-SS602-A	SH06-SS-SS603-A	SH06-SS-SS604-A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	11/11/88	11/11/88	11/11/88	11/11/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH06-SS-SS601-A	SH06-SS-SS602-A	SH06-SS-SS603-A	SH06-SS-SS604-A
3		ARSENIC	6.1	3.5	3.4	5.9
5		BERYLLIUM	1.1	1.0	0.85	1.0
6		CADMIUM	J 1.0			
8		CHROMIUM	J 19	J 18	11	15
12		LEAD	J 11.8	J 11.7	J 12.5	J 13.7
16		NICKEL	16	9.6	13	15

192

SHEPPARD AFB (PHASE I) SH06 SURFACE SOILS

SAMPLE NUMBER:	SH06-SS-SS601-A	SH06-SS-SS602-A	SH06-SS-SS603-A	SH06-SS-SS604-A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	11/11/88	11/11/88	11/11/88	11/11/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

193

SHEPPARD AFB (PHASE I) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-001-1	SH08-SS-SS001-A
DILUTION FACTOR:		1
DESCRIPTION:		
UNITS:	UG/KG	UG/L
DATE SAMPLED:	12/09/88	12/20/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH08 SURFACE SOILS

SAMPLE NUMBER:			SH08-SS-001-1	SH08-SS-SS001-A
DILUTION FACTOR:				1
DESCRIPTION:				
UNITS:			UG/KG	UG/L
DATE SAMPLED:			12/09/88	12/20/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND		
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE		60
39B	206-44-0	FLUORANTHENE		80
84B	129-00-0	PYRENE		80

195

SHEPPARD AFB (PHASE I) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-001-1	SH08-SS-SS001-A
DILUTION FACTOR:		1
DESCRIPTION:		
UNITS:	UG/KG	UG/L
DATE SAMPLED:	12/09/88	12/20/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-001-1	SH08-SS-SS001-A
DILUTION FACTOR:	10	100
DESCRIPTION:		
UNITS:	UG/KG	UG/L
DATE SAMPLED:	12/09/88	12/20/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

197

SHEPPARD AFB (PHASE I) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-001-1	SH08-SS-SS001-A
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	MG/KG	MG/KG
DATE SAMPLED:	12/09/88	12/20/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH08-SS-001-1	SH08-SS-SS001-A
3		ARSENIC	5.3	3
6		CADMIUM	34.3	
8		CHROMIUM	840	10
10		COPPER	110	24.8
12		LEAD	180	32.4
15		MERCURY	0.6	0.21
16		NICKEL	38.4	12.3
18		SELENIUM	0.9	
20		SODIUM	260	
24		ZINC	450	33.4

SHEPPARD AFB (PHASE 1) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-001-1	SH08-SS-SS001-A
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	12/09/88	12/20/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

199

SHEPPARD AFB (PHASE I) SH09 SURFACE SOILS

SAMPLE NUMBER:	SH09-SS-SS901-ASH09-SS-SS901-BSH09-SS-SS902-ASH09-SS-SS902-B
DILUTION FACTOR:	
DESCRIPTION:	

	SH09-SS-SS901-A	SH09-SS-SS901-B	SH09-SS-SS902-A	SH09-SS-SS902-B
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/13/88	11/13/88	11/13/88	11/13/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

208

SHEPPARD AFB (PHASE I) SH09 SURFACE SOILS

SAMPLE NUMBER:	SH09-SS-SS901-A	SH09-SS-SS901-B	SH09-SS-SS902-A	SH09-SS-SS902-B
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/13/88	11/13/88	11/13/88	11/13/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH09 SURFACE SOILS

SAMPLE NUMBER:	SH09-SS-SS901-A	SH09-SS-SS901-B	SH09-SS-SS902-A	SH09-SS-SS902-B
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/13/88	11/13/88	11/13/88	11/13/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

202

SHEPPARD AFB (PHASE I) SH09 SURFACE SOILS

SAMPLE NUMBER:	SH09-SS-SS901-A	SH09-SS-SS901-B	SH09-SS-SS902-A	SH09-SS-SS902-B
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/13/88	11/13/88	11/13/88	11/13/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

203

SHEPPARD AFB (PHASE I) SH09 SURFACE SOILS

SAMPLE NUMBER:	SH09-SS-SS901-A	SH09-SS-SS901-B	SH09-SS-SS902-A	SH09-SS-SS902-B
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	11/13/88	11/13/88	11/13/88	11/13/88

*** INORGANICS ***

PP	CAS NO	COMPOUND				
3		ARSENIC	NA	NA	NA	NA
5		BERYLLIUM	NA	NA	NA	NA
6		CADMIUM	NA	NA	NA	NA
8		CHROMIUM	NA	NA	NA	NA
12		LEAD	NA	NA	NA	NA
16		NICKEL	NA	NA	NA	NA

204

SHEPPARD AFB (PHASE I) SH09 SURFACE SOILS

SAMPLE NUMBER:	SH09-SS-SS901-ASH09-SS-SS901-BSH09-SS-SS902-ASH09-SS-SS902-B
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	11/13/88 11/13/88 11/13/88 11/13/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

205

PHASE II DATA - SURFACE SOILS

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA	NA
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA	NA
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

878

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA	NA
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

909

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

			SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
SAMPLE NUMBER:			SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
DILUTION FACTOR:			1.0	2.0	1.0	1.0	1.0	1.0	1.0
DESCRIPTION:									
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89
*** PESTICIDES ***									
PP	CAS NO	COMPOUND							
93P	72-55-9	4,4'-DDE		25					

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA	NA
DESCRIPTION:							
UNITS:							
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:							
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH02-SS-SS204A	SH02-SS-SS205A	SH02-SS-SS206A	SH02-SS-SS207A	SH02-SS-SS208A	SH02-SS-SS209A	SH02-SS-SS210A
		% MOISTURE	1.5	2.2	1.0	0.4	0.1	4.9	1.8
		PH	7.5	7.0	7.5	7.9	8.3	7.4	7.6
		TOC	10000						

2/2

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS211A	SH02-SS-SS212A	SH02-SS-SS213A	SH02-SS-SS214A	SH02-SS-SS215A	SH02-SS-SS215AD
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA
DESCRIPTION:						DUPLICATE
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

213

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS211A	SH02-SS-SS212A	SH02-SS-SS213A	SH02-SS-SS214A	SH02-SS-SS215A	SH02-SS-SS215AD
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA
DESCRIPTION:						DUPLICATE
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

I-2

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS211A	SH02-SS-SS212A	SH02-SS-SS213A	SH02-SS-SS214A	SH02-SS-SS215A	SH02-SS-SS215AD
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA
DESCRIPTION:						DUPLICATE
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

2-5

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS211A	SH02-SS-SS212A	SH02-SS-SS213A	SH02-SS-SS214A	SH02-SS-SS215A	SH02-SS-SS215AD
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0
DESCRIPTION:						DUPLICATE
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND
93P	72-55-9	4,4'-DDE

2/6

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS211A	SH02-SS-SS212A	SH02-SS-SS213A	SH02-SS-SS214A	SH02-SS-SS215A	SH02-SS-SS215AD
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA
DESCRIPTION:						
UNITS:						
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

217

SHEPPARD AFB (PHASE II) SH02 SURFACE SOILS

SAMPLE NUMBER:	SH02-SS-SS211A	SH02-SS-SS212A	SH02-SS-SS213A	SH02-SS-SS214A	SH02-SS-SS215A	SH02-SS-SS215AD
DILUTION FACTOR:						
DESCRIPTION:						DUPLICATE
UNITS:						
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89	07/12/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH02-SS-SS211A	SH02-SS-SS212A	SH02-SS-SS213A	SH02-SS-SS214A	SH02-SS-SS215A	SH02-SS-SS215AD
		% MOISTURE	13.4	0.7	0.5	0.5	4.1	4.6
		PH	7.1	6.1	7.8	8.0	7.7	7.7
		TOC						

2-8

SHEPPARD AFB (PHASE II) SH03 SURFACE SOILS

SAMPLE NUMBER:	SH03-SS-SS304A	SH03-SS-SS305A	SH03-SS-SS306A	SH03-SS-SS307A
DILUTION FACTOR:	NA	NA	NA	NA
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

219

SHEPPARD AFB (PHASE II) SH03 SURFACE SOILS

SAMPLE NUMBER:	SH03-SS-SS304A	SH03-SS-SS305A	SH03-SS-SS306A	SH03-SS-SS307A
DILUTION FACTOR:	NA	NA	NA	NA
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH03 SURFACE SOILS

SAMPLE NUMBER:	SH03-SS-SS304A	SH03-SS-SS305A	SH03-SS-SS306A	SH03-SS-SS307A
DILUTION FACTOR:	NA	NA	NA	NA
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

22

SHEPPARD AFB (PHASE II) SH03 SURFACE SOILS

SAMPLE NUMBER:	SH03-SS-SS304A	SH03-SS-SS305A	SH03-SS-SS306A	SH03-SS-SS307A
DILUTION FACTOR:	1.0	5.0/10.0	2/5	2/5
DESCRIPTION:				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND	SH03-SS-SS304A	SH03-SS-SS305A	SH03-SS-SS306A	SH03-SS-SS307A
104P	319-86-8	DELTA-BHC	17			
100P	76-44-8	HEPTACHLOR				200
92P	50-29-3	4,4'-DDT	36	85	49	58
93P	72-55-9	4,4'-DDE	19	170	67	81
90P	60-57-1	DIELDRIN		150		
91P	57-74-9	GAMMA CHLORDANE		100		270

222

SHEPPARD AFB (PHASE II) SH03 SURFACE SOILS

SAMPLE NUMBER:	SH03-SS-SS304A	SH03-SS-SS305A	SH03-SS-SS306A	SH03-SS-SS307A
DILUTION FACTOR:	NA	NA	NA	NA
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

223

SHEPPARD AFB (PHASE II) SH03 SURFACE SOILS

SAMPLE NUMBER:	SH03-SS-SS304A	SH03-SS-SS305A	SH03-SS-SS306A	SH03-SS-SS307A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	07/12/89	07/12/89	07/12/89	07/12/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND				
		% MOISTURE	4.0	4.0	20.9	6.6
		PH	5.6	6.3	7.5	7.4
		TOC	15000			

924

SHEPPARD AFB (PHASE II) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
DILUTION FACTOR:	NA	NA	NA
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/15/89	07/15/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

225

SHEPPARD AFB (PHASE II) SH08 SURFACE SOILS

SAMPLE NUMBER:			SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
DILUTION FACTOR:			1.0	1.0	1.0
DESCRIPTION:					
UNITS:			UG/KG	UG/KG	UG/KG
DATE SAMPLED:			07/15/89	07/15/89	07/15/89
*** BASE/NEUTRALS ***					
PP	CAS NO	COMPOUND			
68B	84-74-2	DI-N-BUTYL PHTHALATE	550	280J	270J
74B	205-99-2	BENZO(B)FLUORANTHENE	65J		
73B	50-32-8	BENZO(A)PYRENE	54J		
84B	129-00-0	PYRENE	31J		42J

926

SHEPPARD AFB (PHASE II) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
DILUTION FACTOR:	1.0	1.0	1.0
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/15/89	07/15/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

927

SHEPPARD AFB (PHASE II) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
DILUTION FACTOR:	10/50	2/5	40/100
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/15/89	07/15/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND	SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
	319-84-6	ALPHA-CHLORDANE			2300
101P	1024-57-3	HEPTACHLOR EPOXIDE	42		
92P	50-29-3	4,4'-DDT	1100	61	930
	72-54-8	4,4'-DDD		50	
93P	72-55-9	4,4'-DDE	1400	56	
91P	57-74-9	GAMMA CHLORDANE			2900

SHEPPARD AFB (PHASE II) SH08 SURFACE SOILS

SAMPLE NUMBER:			SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
DILUTION FACTOR:					
DESCRIPTION:					
UNITS:			MG/KG	MG/KG	MG/KG
DATE SAMPLED:			07/15/89	07/15/89	07/15/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
3		ARSENIC	2.7J	3.0J	1.6J
5		BERYLLIUM	0.60	[0.49]	0.56
6		CADMIUM	1.1	0.61	1.6
8		CHROMIUM	16.5	9.5	12.3
10		COPPER	10.9	8.0	15.4
12		LEAD	89.0J	14.7J	35.7J
15		MERCURY			1.7
16		NICKEL	9.2	8.3	12.3
19		SILVER	2.4		1.1
24		ZINC	57.9	28.9	99.8

929

SHEPPARD AFB (PHASE II) SH08 SURFACE SOILS

SAMPLE NUMBER:	SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:			
DATE SAMPLED:	07/15/89	07/15/89	07/15/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH08-SS-SS802A	SH08-SS-SS803A	SH08-SS-SS804A
		% MOISTURE	17.5	18.5	12.1
		PH	7.1	7.6	6.8
		CATION EXCHANGE CAPACITY (MEQ/100G)	24.5		
		TOC	9100		

230

PHASE I DATA - SUBSURFACE SOILS

SHEPPARD AFB (PHASE I) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW201-A	SH02-SU-MW201-X	SH02-SU-MW202-A	SH02-SU-MW203-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:	DUPLICATE	DUPLICATE		
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/08/88	11/08/88	11/09/88	11/10/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW201-A	SH02-SU-MW201-X	SH02-SU-MW202-A	SH02-SU-MW203-A
DILUTION FACTOR:				
DESCRIPTION:	DUPLICATE	DUPLICATE		
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/08/88	11/08/88	11/09/88	11/10/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW201-A	SH02-SU-MW201-X	SH02-SU-MW202-A	SH02-SU-MW203-A
DILUTION FACTOR:				
DESCRIPTION:	DUPLICATE	DUPLICATE		
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/08/88	11/08/88	11/09/88	11/10/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

234

SHEPPARD AFB (PHASE I) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW201-A	SH02-SU-MW201-X	SH02-SU-MW202-A	SH02-SU-MW203-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0
DESCRIPTION:	DUPLICATE	DUPLICATE		
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/08/88	11/08/88	11/09/88	11/10/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

235

SHEPPARD AFB (PHASE I) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW201-A	SH02-SU-MW201-X	SH02-SU-MW202-A	SH02-SU-MW203-A
DILUTION FACTOR:				
DESCRIPTION:	DUPLICATE	DUPLICATE		
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	11/08/88	11/08/88	11/09/88	11/10/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH02-SU-MW201-A	SH02-SU-MW201-X	SH02-SU-MW202-A	SH02-SU-MW203-A
3		ARSENIC	1.84	1.84	1.2	2.57
5		BERYLLIUM	0.56	0.77	1.4	0.52
8		CHROMIUM	14	17	26	26
12		LEAD	J 12.6	J 6.2	J 5.6	J 2.58
16		NICKEL	16	17	24	24
24		ZINC	55	65		

236

SHEPPARD AFB (PHASE I) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW201-A	SH02-SU-MW201-X	SH02-SU-MW202-A	SH02-SU-MW203-A
DILUTION FACTOR:				
DESCRIPTION:	DUPLICATE	DUPLICATE		
UNITS:				
DATE SAMPLED:	11/08/88	11/08/88	11/09/88	11/10/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND				
		CATION EXCHANGE CAPACITY MEQ/100G	7.6	5.4	NA	NA
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA	NA	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA	NA	NA	NA

237

SHEPPARD AFB (PHASE I) SH03 SUBSURFACE SOILS

SAMPLE NUMBER:	SH03-SU-MW301-A	SH03-SU-MW302-A	SH03-SU-MW303-A
DILUTION FACTOR:	1.0	1.0	1.0
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/13/88	11/13/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

238

SHEPPARD AFB (PHASE I) SH03 SUBSURFACE SOILS

SAMPLE NUMBER:	SH03-SU-MW301-A	SH03-SU-MW302-A	SH03-SU-MW303-A
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/13/88	11/13/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

239

SHEPPARD AFB (PHASE I) SH03 SUBSURFACE SOILS

SAMPLE NUMBER:	SH03-SU-MW301-A	SH03-SU-MW302-A	SH03-SU-MW303-A
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/13/88	11/13/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH03 SUBSURFACE SOILS

SAMPLE NUMBER:	SH03-SU-MW301-A	SH03-SU-MW302-A	SH03-SU-MW303-A
DILUTION FACTOR:	1.0	1.0	1.0
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/13/88	11/13/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

P
I

SHEPPARD AFB (PHASE I) SH03 SUBSURFACE SOILS

SAMPLE NUMBER:	SH03-SU-MW301-A	SH03-SU-MW302-A	SH03-SU-MW303-A
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	11/12/88	11/13/88	11/13/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH03-SU-MW301-A	SH03-SU-MW302-A	SH03-SU-MW303-A
3		ARSENIC	3.56	1.67	2.38
5		BERYLLIUM	1.1	1.0	2.4
8		CHROMIUM	32	29	34
12		LEAD	J 4.1	J 5.4	J 5.7
16		NICKEL	37	30	36
24		ZINC	56	80	54

SHEPPARD AFB (PHASE I) SH03 SUBSURFACE SOILS

SAMPLE NUMBER:		SH03-SU-MW301-A	SH03-SU-MW302-A	SH03-SU-MW303-A
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:		11/12/88	11/13/88	11/13/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND			
		CATION EXCHANGE CAPACITY MEQ/100G	38.8	NA	NA
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA	NA	NA

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	12/12/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

914

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
DILUTION FACTOR:							1
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	12/12/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
DILUTION FACTOR:							1
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	12/12/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0	1
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	12/12/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

917

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	12/12/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
3		ARSENIC	2.63		2.75	4.62	2.59	5.8	1.9
5		BERYLLIUM	1.1	1.9	1.1	1.5	1.7	1.1	1.4
6		CADMIUM			J 1.0				
8		CHROMIUM	31	37	31	35	46	30	J 42.9
10		COPPER			J 9.8				12
12		LEAD	J 6.7	J 1.52	J 5.72	J 13.7	J 7.0	J 14.8	8.3
15		MERCURY							
16		NICKEL	30	32	36	27	31	30	J 39
19		SILVER							
24		ZINC	66		83		54	51	40.6

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
SAMPLE NUMBER:	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:							
DATE SAMPLED:	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	11/12/88	12/12/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH04-SU-MW401-A	SH04-SU-MW401-B	SH04-SU-MW401-C	SH04-SU-MW402-A	SH04-SU-MW402-B	SH04-SU-MW402-C	SH04-SU-SB403-A
		CATION EXCHANGE CAPACITY MEQ/100G	NA	NA	NA	NA	NA	NA	38.6
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA	NA	NA	NA	NA	NA	NA

919

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-SB403-B	SH04-SU-SB403-C
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/12/88	12/12/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

250

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-SB403-B	SH04-SU-SB403-C
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/12/88	12/12/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

25

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-SB403-B	SH04-SU-SB403-C
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/12/88	12/12/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

252

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-SB403-B	SH04-SU-SB403-C
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/12/88	12/12/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

253

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-SB403-B	SH04-SU-SB403-C
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	MG/KG	MG/KG
DATE SAMPLED:	12/12/88	12/12/88

*** INORGANICS ***

PP	CAS NO	COMPOUND		
3		ARSENIC	0.8	3
5		BERYLLIUM	2.2	1.4
6		CADMIUM		1.1
8		CHROMIUM	J 47.6	J 31.1
10		COPPER	7.2	9.2
12		LEAD	6.3	5.4
15		MERCURY	0.2	0.2
16		NICKEL	J 42.3	J 31.9
19		SILVER	10.9	
24		ZINC	48.8	42.1

I 52

SHEPPARD AFB (PHASE I) SH04 SUBSURFACE SOILS

SAMPLE NUMBER:	SH04-SU-SB403-B	SH04-SU-SB403-C
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	12/12/88	12/12/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH04-SU-SB403-B	SH04-SU-SB403-C
		CATION EXCHANGE CAPACITY MEQ/100G	27.6	29.0
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-MW503-A	SH05-SU-MW503-B	SH05-SU-MW503-C	SH05-SU-SB501-A	SH05-SU-SB501-B	SH05-SU-SB501-C	SH05-SU-SB502-A
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/08/88	12/08/88	12/08/88	12/08/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

256

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-MW503-A	SH05-SU-MW503-B	SH05-SU-MW503-C	SH05-SU-SB501-A	SH05-SU-SB501-B	SH05-SU-SB501-C	SH05-SU-SB502-A
DILUTION FACTOR:	1	1	1	1	1	1	1
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/08/88	12/08/88	12/08/88	12/08/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-MW503-A	SH05-SU-MW503-B	SH05-SU-MW503-C	SH05-SU-SB501-A	SH05-SU-SB501-B	SH05-SU-SB501-C	SH05-SU-SB502-A
DILUTION FACTOR:	1	1	1	1	1	1	1
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/08/88	12/08/88	12/08/88	12/08/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

258

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-MW503-A	SH05-SU-MW503-B	SH05-SU-MW503-C	SH05-SU-SB501-A	SH05-SU-SB501-B	SH05-SU-SB501-C	SH05-SU-SB502-A
DILUTION FACTOR:				1	1	1	1
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/08/88	12/08/88	12/08/88	12/08/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

259

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:			SH05-SU-MW503-A	SH05-SU-MW503-B	SH05-SU-MW503-C	SH05-SU-SB501-A	SH05-SU-SB501-B	SH05-SU-SB501-C	SH05-SU-SB502-A
DILUTION FACTOR:									
DESCRIPTION:									
UNITS:			MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:			12/09/88	12/09/88	12/09/88	12/08/88	12/08/88	12/08/88	12/08/88
*** INORGANICS ***									
PP	CAS NO	COMPOUND							
3		ARSENIC	5.7	1.3	1.7	2.1	2.3	2.6	4
8		CHROMIUM	18.3	7.3	10.7	8.7	11.4	11.1	10
10		COPPER	13.8	7.4	6.5	8.6	13	34.9	8.2
12		LEAD	12	3.8	2.4	2.8	3.8	59	7.5
15		MERCURY	0.2	0.2		0.1	0.2	0.2	0.2
16		NICKEL	31.9	15.7	19	11.1	15	18.2	10.3
24		ZINC	27.7	24.7	40.6	17.9	38.9	130	25

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-MW503-A	SH05-SU-MW503-B	SH05-SU-MW503-C	SH05-SU-SB501-A	SH05-SU-SB501-B	SH05-SU-SB501-C	SH05-SU-SB502-A
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:							
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/08/88	12/08/88	12/08/88	12/08/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND							
		CATION EXCHANGE CAPACITY MEQ/100G	NA	NA	NA	NA	NA	NA	NA
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA	NA	NA	NA	NA	NA	NA

96

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

	SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
SAMPLE NUMBER:	SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
DILUTION FACTOR:					
DESCRIPTION:					
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88	12/08/88	12/08/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

262

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
DILUTION FACTOR:	1	1			
DESCRIPTION:					
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88	12/08/88	12/08/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

263

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
DILUTION FACTOR:	1	1			
DESCRIPTION:					
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88	12/08/88	12/08/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
DILUTION FACTOR:	1	1	1	1	1
DESCRIPTION:					
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88	12/08/88	12/08/88	12/08/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

265

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

			SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
SAMPLE NUMBER:			SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:			MG/KG	MG/KG			
DATE SAMPLED:			12/08/88	12/08/88	12/08/88	12/08/88	12/08/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
3		ARSENIC	3.5	1.4			
8		CHROMIUM	12.7	6.6			
10		COPPER	8.3	7.7			
12		LEAD	5.5	11.6			
15		MERCURY	0.2	0.2			
16		NICKEL	16.7				
24		ZINC	45.1	69.1			

266

SHEPPARD AFB (PHASE I) SH05 SUBSURFACE SOILS

SAMPLE NUMBER:	SH05-SU-SB502-B	SH05-SU-SB502-C	SH05-SU-SB503-A	SH05-SU-SB503-B	SH05-SU-SB503-C
DILUTION FACTOR:					
DESCRIPTION:					
UNITS:					
DATE SAMPLED:	12/08/88	12/08/88	12/08/88	12/08/88	12/08/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND					
		CATION EXCHANGE CAPACITY MEQ/100G	NA	NA	NA	NA	NA
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA	NA	NA	NA	NA

267

SHEPPARD AFB (PHASE I) SH06 SUBSURFACE SOIL

SAMPLE NUMBER:	SH06-SU-MW601-A
DILUTION FACTOR:	1.0
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	11/11/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH06 SUBSURFACE SOIL

SAMPLE NUMBER:	SH06-SU-MW601-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	11/11/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH06 SUBSURFACE SOIL

SAMPLE NUMBER:	SH06-SU-MW601-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	11/11/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH06 SUBSURFACE SOIL

SAMPLE NUMBER:	SH06-SU-MW601-A
DILUTION FACTOR:	1.0
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	11/11/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

21

SHEPPARD AFB (PHASE I) SH06 SUBSURFACE SOIL

SAMPLE NUMBER:	SH06-SU-MW601-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	MG/KG
DATE SAMPLED:	11/11/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	
3		ARSENIC	4.1
5		BERYLLIUM	1.2
8		CHROMIUM	J 22
12		LEAD	J 9.84
16		NICKEL	20

272

SHEPPARD AFB (PHASE I) SH06 SUBSURFACE SOIL

SAMPLE NUMBER:	SH06-SU-MW601-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	11/11/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	
		CATION EXCHANGE CAPACITY MEQ/100G	16.9
		GAMMA EMITTERS TH 232 (pCi/g)	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA

SHEPPARD AFB (PHASE I) SH07 SUBSURFACE SOILS

	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
SAMPLE NUMBER:	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
DILUTION FACTOR:						
DESCRIPTION:						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/07/88	12/07/88	12/07/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

212

SHEPPARD AFB (PHASE I) SH07 SUBSURFACE SOILS

SAMPLE NUMBER:	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
DILUTION FACTOR:	1	1	1	1	1	1
DESCRIPTION:						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/07/88	12/07/88	12/07/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

275

SHEPPARD AFB (PHASE I) SH07 SUBSURFACE SOILS

SAMPLE NUMBER:	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
DILUTION FACTOR:	1	1	1	1	1	1
DESCRIPTION:						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/07/88	12/07/88	12/07/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH07 SUBSURFACE SOILS

SAMPLE NUMBER:	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
DILUTION FACTOR:	1	1	1	1	1	1
DESCRIPTION:						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/07/88	12/07/88	12/07/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH07 SUBSURFACE SOILS

SAMPLE NUMBER:	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
DILUTION FACTOR:						
DESCRIPTION:						
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/07/88	12/07/88	12/07/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
3		ARSENIC	1.3	7.6	42.4	1.6		
5		BERYLLIUM			2.2	0.6	0.6	0.7
6		CADMIUM		J 2.3	J 2.8			
8		CHROMIUM	14.2	8	22.6	42.8	12.1	56.9
10		COPPER	14.3	59.5	440	J 42	J 35	J 33
12		LEAD	3.6	4	4.3	2.2	1.8	2.7
15		MERCURY	0.1	0.1	0.2	0.2	0.2	0.3
16		NICKEL	15.5	14.2	41.3	18.7	11.7	42.1
24		ZINC	27.7	33.4	79.8	J 31.1	J 24.6	J 54.3

SHEPPARD AFB (PHASE I) SH07 SUBSURFACE SOILS

SAMPLE NUMBER:	SH07-SU-MW702-A	SH07-SU-MW702-B	SH07-SU-MW702-C	SH07-SU-SB701-A	SH07-SU-SB701-B	SH07-SU-SB701-C
DILUTION FACTOR:						
DESCRIPTION:						
UNITS:						
DATE SAMPLED:	12/09/88	12/09/88	12/09/88	12/07/88	12/07/88	12/07/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND						
		CATION EXCHANGE CAPACITY MEQ/100G	NA	NA	NA	NA	9.4	NA
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA	NA	NA	NA	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA	NA	NA	NA	NA	NA

279

SHEPPARD AFB (PHASE I) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-SB801-A	SH08-SU-SB801-B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/06/88	12/06/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

250

SHEPPARD AFB (PHASE I) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-SB801-A	SH08-SU-SB801-B
DILUTION FACTOR:	5	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/06/88	12/06/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND		
	91-57-6	2-METHYLNAPHTHALENE	23000	
81B	85-01-8	PHENANTHRENE	5700	

981

SHEPPARD AFB (PHASE I) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-SB801-A	SH08-SU-SB801-B
DILUTION FACTOR:	5	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/06/88	12/06/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

282

SHEPPARD AFB (PHASE I) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-SB801-A	SH08-SU-SB801-B
DILUTION FACTOR:		1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/06/88	12/06/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

283

SHEPPARD AFB (PHASE I) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-SB801-A	SH08-SU-SB801-B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	MG/KG	MG/KG
DATE SAMPLED:	12/06/88	12/06/88

*** INORGANICS ***

PP	CAS NO	COMPOUND		
2		ANTIMONY	J 11.1	J 13.9
3		ARSENIC	3	
5		BERYLLIUM	0.7	1.9
8		CHROMIUM	10.7	33.5
10		COPPER	J 93.7	J 51
12		LEAD	11.8	4.6
15		MERCURY	0.2	0.2
16		NICKEL	6.4	29
24		ZINC	J 240	J 49.2

SHEPPARD AFB (PHASE I) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-SB801-A	SH08-SU-SB801-B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	12/06/88	12/06/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND		
		CATION EXCHANGE CAPACITY MEQ/100G	NA	10.4
		GAMMA EMITTERS TH 232 (pCi/g)	NA	NA
		GAMMA EMITTERS RA 228 (pCi/g)	NA	NA
		GAMMA EMITTERS RA 226 (pCi/g)	NA	NA

285

SHEPPARD AFB (PHASE I) SH11 SUBSURFACE SOIL

SAMPLE NUMBER:	SH11-SU-SB111-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/11/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH11 SUBSURFACE SOIL

SAMPLE NUMBER:	SH11-SU-SB111-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/11/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

23

SHEPPARD AFB (PHASE I) SH11 SUBSURFACE SOIL

SAMPLE NUMBER:	SH11-SU-SB111-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/11/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

988

SHEPPARD AFB (PHASE I) SH11 SUBSURFACE SOIL

SAMPLE NUMBER:	SH11-SU-SB111-A
DILUTION FACTOR:	1
DESCRIPTION:	
UNITS:	UG/KG
DATE SAMPLED:	12/11/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

289

SHEPPARD AFB (PHASE I) SH11 SUBSURFACE SOIL

SAMPLE NUMBER:	SH11-SU-SB111-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	MG/KG
DATE SAMPLED:	12/11/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	
3		ARSENIC	1.8
5		BERYLLIUM	1.4
8		CHROMIUM	J 30.9
10		COPPER	18.3
12		LEAD	7
15		MERCURY	0.1
16		NICKEL	J 36.1
24		ZINC	63.3

SHEPPARD AFB (PHASE I) SH11 SUBSURFACE SOIL

SAMPLE NUMBER:	SH11-SU-SB111-A
DILUTION FACTOR:	
DESCRIPTION:	
UNITS:	
DATE SAMPLED:	12/11/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	
		CATION EXCHANGE CAPACITY MEQ/100G	9.44
		GAMMA EMITTERS TH 232 (pCi/g)	2.0±0.2
		GAMMA EMITTERS RA 228 (pCi/g)	1.8±0.2
		GAMMA EMITTERS RA 226 (pCi/g)	1.1±0.2

961

PHASE II DATA - SUBSURFACE SOILS

SHEPPARD AFB (PHASE II) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW204A	SH02-SU-MW204B
DILUTION FACTOR:	NA	NA
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	07/14/89	07/14/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW204A	SH02-SU-MW204B
DILUTION FACTOR:	NA	NA
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	07/14/89	07/14/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW204A	SH02-SU-MW204B
DILUTION FACTOR:	NA	NA
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	07/14/89	07/14/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW204A	SH02-SU-MW204B
DILUTION FACTOR:	1.0	1.0
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	07/14/89	07/14/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW204A	SH02-SU-MW204B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	MG/KG	MG/KG
DATE SAMPLED:	07/14/89	07/14/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH02-SU-MW204A	SH02-SU-MW204B
2		ANTIMONY		11.1J
3		ARSENIC	4.4J	1.5J
5		BERYLLIUM	0.54	[0.43]
6		CADMIUM	0.97	
8		CHROMIUM	14.2	11.4
10		COPPER	6.7	5.5
12		LEAD	39.4J	7.5J
16		NICKEL	13.4	19.6
19		SILVER	2.1	1.1
24		ZINC	44.6	33.8

967

SHEPPARD AFB (PHASE II) SH02 SUBSURFACE SOILS

SAMPLE NUMBER:	SH02-SU-MW204A	SH02-SU-MW204B
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	07/14/89	07/14/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH02-SU-MW204A	SH02-SU-MW204B
		% MOISTURE	7.4	7.8
		PH	7.8	8.2
		TOC	99	400

968

SHEPPARD AFB (PHASE II) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
DILUTION FACTOR:	NA	NA	NA	NA	NA	NA
DESCRIPTION:						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/14/89	07/14/89	07/14/89	07/14/89	07/14/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

969

SHEPPARD AFB (PHASE II) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:			SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
DILUTION FACTOR:			1.0	1.0	1.0	1.0	1.0	1.0
DESCRIPTION:								
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			07/15/89	07/14/89	07/14/89	07/14/89	07/14/89	07/14/89
*** BASE/NEUTRALS ***								
PP	CAS NO	COMPOUND						
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE				18J		
68B	84-74-2	DI-N-BUTYL PHTHALATE	330	380	120J	510	236J	130J

SHEPPARD AFB (PHASE II) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0
DESCRIPTION:						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/14/89	07/14/89	07/14/89	07/14/89	07/14/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:			SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
DILUTION FACTOR:			2/10	1	1	1000/2000	40	1
DESCRIPTION:								
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			07/15/89	07/14/89	07/14/89	07/14/89	07/14/89	07/14/89
*** PESTICIDES ***								
PP	CAS NO	COMPOUND						
	319-84-6	ALPHA-CHLORDANE				19000	440	
92P	50-29-3	4,4'-DDT	69					
	72-54-8	4,4'-DDD				66000	520	
93P	72-55-9	4,4'-DDE	120					
91P	57-74-9	GAMMA CHLORDANE				17000	460	

SHEPPARD AFB (PHASE II) SH08 SUBSURFACE SOILS

			SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
SAMPLE NUMBER:			SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
DILUTION FACTOR:								
DESCRIPTION:								
UNITS:			MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:			07/15/89	07/14/89	07/14/89	07/14/89	07/14/89	07/14/89
*** INORGANICS ***								
PP	CAS NO	COMPOUND						
2		ANTIMONY					9.1J	
3		ARSENIC	13.8J	13.0J	[0.37]J	1.8J	1.2J	5.9J
5		BERYLLIUM	0.66	[0.35]	[0.34]	0.61		[0.44]
6		CADMIUM				1.8		
8		CHROMIUM	10.3	9.8	9.8	24.4	8.6	16.3
10		COPPER	6.7	8.8	4.5	67.0	12.4	19.7
12		LEAD	23.2J	19.4J	11.9J	141J	11.0J	76.4J
15		MERCURY				4.0		
16		NICKEL	10.5	12.0	15.8	15.7	13.8	18.4
19		SILVER	1.1			7.3	2.3	
24		ZINC			30.6	194	27.4	96.9

SHEPPARD AFB (PHASE II) SH08 SUBSURFACE SOILS

SAMPLE NUMBER:	SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
DILUTION FACTOR:						
DESCRIPTION:						
UNITS:						
DATE SAMPLED:	07/15/89	07/14/89	07/14/89	07/14/89	07/14/89	07/14/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH08-SU-MW802A	SH08-SU-MW802B	SH08-SU-MW802C	SH08-SU-MW803A	SH08-SU-MW803B	SH08-SU-MW803C
		% MOISTURE	10.7	15.3	13.3	19.1	13.6	11.3
		PH	8.6	10.3	8.6	7.9	8.2	8.1
		PETROLEUM HYDROCARBONS			98	180		78
		CATION EXCHANGE CAPACITY (MEQ/100G)	15.5					

SHEPPARD AFB (PHASE II) SH13 SUBSURFACE SOILS

SAMPLE NUMBER:	SH13-SU-MW131A	SH13-SU-MW132A	SH13-SU-MW132AD	SH13-SU-MW133A	SH13-SU-MW134A
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0
DESCRIPTION:			DUPLICATE		
UNITS:	UG/KG	UG/KG	MG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/15/89	07/15/89	07/15/89	07/15/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

305

SHEPPARD AFB (PHASE II) SH13 SUBSURFACE SOILS

SAMPLE NUMBER:	SH13-SU-MW131A	SH13-SU-MW132A	SH13-SU-MW132AD	SH13-SU-MW133A	SH13-SU-MW134A
DILUTION FACTOR:	1.0	1.0	1.0	1.0	NA
DESCRIPTION:			DUPLICATE		
UNITS:	UG/KG	UG/KG	MG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/15/89	07/15/89	07/15/89	07/15/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

306

SHEPPARD AFB (PHASE II) SH13 SUBSURFACE SOILS

SAMPLE NUMBER:	SH13-SU-MW131A	SH13-SU-MW132A	SH13-SU-MW132AD	SH13-SU-MW133A	SH13-SU-MW134A
DILUTION FACTOR:	1.0	1.0	1.0	1.0	NA
DESCRIPTION:			DUPLICATE		
UNITS:	UG/KG	UG/KG	MG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/15/89	07/15/89	07/15/89	07/15/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

SHEPPARD AFB (PHASE II) SH13 SUBSURFACE SOILS

SAMPLE NUMBER:	SH13-SU-MW131A	SH13-SU-MW132A	SH13-SU-MW132AD	SH13-SU-MW133A	SH13-SU-MW134A
DILUTION FACTOR:	NA	NA	NA	NA	NA
DESCRIPTION:			DUPLICATE		
UNITS:	UG/KG	UG/KG	MG/KG	UG/KG	UG/KG
DATE SAMPLED:	07/15/89	07/15/89	07/15/89	07/15/89	07/15/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

308

SHEPPARD AFB (PHASE II) SH13 SUBSURFACE SOILS

SAMPLE NUMBER:	SH13-SU-MW131A	SH13-SU-MW132A	SH13-SU-MW132AD	SH13-SU-MW133A	SH13-SU-MW134A
DILUTION FACTOR:	NA	NA	NA	NA	NA
DESCRIPTION:					
UNITS:					
DATE SAMPLED:	07/15/89	07/15/89	07/15/89	07/15/89	07/15/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

309

SHEPPARD AFB (PHASE II) SH13 SUBSURFACE SOILS

SAMPLE NUMBER:	SH13-SU-MW131A	SH13-SU-MW132A	SH13-SU-MW132AD	SH13-SU-MW133A	SH13-SU-MW134A
DILUTION FACTOR:					
DESCRIPTION:			DUPLICATE		
UNITS:					
DATE SAMPLED:	07/15/89	07/15/89	07/15/89	07/15/89	07/15/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH13-SU-MW131A	SH13-SU-MW132A	SH13-SU-MW132AD	SH13-SU-MW133A	SH13-SU-MW134A
		% MOISTURE	14.0	14.6	13.2	12.9	15.4
		PH	7.9	7.0	7.3	7.7	7.8
		CATION EXCHANGE CAPACITY (MEQ/100G)	13.1	21.9	27.0		
		TOC	66	2500	1800		

PHASE I DATA - SEDIMENTS

SHEPPARD AFB (PHASE I) SH03 SEDIMENTS

SAMPLE NUMBER:	SH03-SE-001-1	SH03-SE-001-1D
DILUTION FACTOR:		
DESCRIPTION:		DUPLICATE
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE 1) SH03 SEDIMENTS

SAMPLE NUMBER:	SH03-SE-001-1	SH03-SE-001-1D
DILUTION FACTOR:		
DESCRIPTION:		DUPLICATE
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

313

SHEPPARD AFB (PHASE I) SH03 SEDIMENTS

SAMPLE NUMBER:	SH03-SE-001-1	SH03-SE-001-1D
DILUTION FACTOR:		
DESCRIPTION:		DUPLICATE
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

3-I

SHEPPARD AFB (PHASE I) SH03 SEDIMENTS

SAMPLE NUMBER:	SH03-SE-001-1	SH03-SE-001-1D
DILUTION FACTOR:	1	1
DESCRIPTION:		DUPLICATE
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

315

SHEPPARD AFB (PHASE I) SH03 SEDIMENTS

SAMPLE NUMBER:	SH03-SE-001-1	SH03-SE-001-1D
DILUTION FACTOR:		
DESCRIPTION:		DUPLICATE
UNITS:	MG/KG	MG/KG
DATE SAMPLED:	12/07/88	12/07/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH03-SE-001-1	SH03-SE-001-1D
3		ARSENIC	2.6	2.9
5		BERYLLIUM		1.1
8		CHROMIUM	77.2	68.9
10		COPPER	J 44	J 51.4
12		LEAD	78.1	120
15		MERCURY	1.1	1.4
16		NICKEL	36.4	24.8
19		SILVER	J 2.3	J 2.7
24		ZINC	J 110	J 130

316

SHEPPARD AFB (PHASE I) SH03 SEDIMENTS

SAMPLE NUMBER:	SH03-SE-001-1	SH03-SE-001-1D
DILUTION FACTOR:		
DESCRIPTION:	DUPLICATE	
UNITS:		
DATE SAMPLED:	12/07/88	12/07/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SEDIMENTS

SAMPLE NUMBER:	SH04-SE-001-1	SH04-SE-002-1
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

3/8

SHEPPARD AFB (PHASE I) SH04 SEDIMENTS

SAMPLE NUMBER:	SH04-SE-001-1	SH04-SE-002-1
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

319

SHEPPARD AFB (PHASE I) SH04 SEDIMENTS

SAMPLE NUMBER:	SH04-SE-001-1	SH04-SE-002-1
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SEDIMENTS

SAMPLE NUMBER:	SH04-SE-001-1	SH04-SE-002-1
DILUTION FACTOR:		1
DESCRIPTION:		
UNITS:	UG/KG	UG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

321

SHEPPARD AFB (PHASE I) SH04 SEDIMENTS

SAMPLE NUMBER:	SH04-SE-001-1	SH04-SE-002-1
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:	MG/KG	MG/KG
DATE SAMPLED:	12/08/88	12/08/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH04-SE-001-1	SH04-SE-002-1
3		ARSENIC	6.7	6.4
5		BERYLLIUM	2.2	2.1
8		CHROMIUM	25.5	27.5
10		COPPER	21.4	19.3
12		LEAD	J 29.9	
15		MERCURY	0.5	0.5
16		NICKEL	34.1	32.5
24		ZINC	J 62.1	J 59.2

322

SHEPPARD AFB (PHASE I) SH04 SEDIMENTS

SAMPLE NUMBER:	SH04-SE-001-1	SH04-SE-002-1
DILUTION FACTOR:		
DESCRIPTION:		
UNITS:		
DATE SAMPLED:	12/08/88	12/08/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

323

PHASE I DATA - SURFACE WATER

SHEPPARD AFB (PHASE I) SH03 SURFACE WATER

SAMPLE NUMBER:	SH03-SW-001-1	SH03-SW-001-1D
DILUTION FACTOR:	1	1
DESCRIPTION:		DUPLICATE
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/07/88	12/07/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

325

SHEPPARD AFB (PHASE I) SH03 SURFACE WATER

SAMPLE NUMBER:	SH03-SW-001-1	SH03-SW-001-1D
DILUTION FACTOR:	1	
DESCRIPTION:		DUPLICATE
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/07/88	12/07/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH03 SURFACE WATER

SAMPLE NUMBER:	SH03-SW-001-1	SH03-SW-001-1D
DILUTION FACTOR:	1	
DESCRIPTION:		DUPLICATE
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/07/88	12/07/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

327

SHEPPARD AFB (PHASE I) SH03 SURFACE WATER

SAMPLE NUMBER:	SH03-SW-001-1	SH03-SW-001-1D
DILUTION FACTOR:	1	1
DESCRIPTION:		DUPLICATE
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/07/88	12/07/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH03 SURFACE WATER

SAMPLE NUMBER:	SH03-SW-001-1	SH03-SW-001-1D
DILUTION FACTOR:		
DESCRIPTION:		DUPLICATE
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/07/88	12/07/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH03-SW-001-1	SH03-SW-001-1D
2		ANTIMONY		J 66.3
3		ARSENIC	J 74.6	
19		SILVER		J 7.8
24		ZINC		J 128
25		CYANIDE	80.0	17.5

SHEPPARD AFB (PHASE I) SH03 SURFACE WATER

SAMPLE NUMBER:	SH03-SW-001-1	SH03-SW-001-1D
DILUTION FACTOR:		
DESCRIPTION:		DUPLICATE
UNITS:	MG/L	MG/L
DATE SAMPLED:	12/07/88	12/07/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH03-SW-001-1	SH03-SW-001-1D
		CHLORIDE	150.0	147.0
		CYANIDE UG/L	J 80.3	J 17.5
		NITRITE (as N)	0.4	0.3
		SULFATE	53.6	47.9
		TDS	431	460
		FLUORIDE	2.2	2.3
		BROMIDE	0.74	0.57
		PHOSPHATE, ORTHO	16.0	15.0
		PHOSPHATE, TOTAL UG/L	4980	4810

330

SHEPPARD AFB (PHASE I) SH04 SURFACE WATER

SAMPLE NUMBER:	SH04-SW-001-1	SH04-SW-002-1
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/08/88	12/08/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

331

SHEPPARD AFB (PHASE I) SH04 SURFACE WATER

SAMPLE NUMBER:	SH04-SW-001-1	SH04-SW-002-1
DILUTION FACTOR:	1	2
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/08/88	12/08/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	SH04-SW-001-1	SH04-SW-002-1
67B	85-68-7	BUTYL BENZYL PHTHALATE		6

SHEPPARD AFB (PHASE I) SH04 SURFACE WATER

SAMPLE NUMBER:	SH04-SW-001-1	SH04-SW-002-1
DILUTION FACTOR:	1	2
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/08/88	12/08/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

333

SHEPPARD AFB (PHASE I) SH04 SURFACE WATER

SAMPLE NUMBER:	SH04-SW-001-1	SH04-SW-002-1
DILUTION FACTOR:	1	1
DESCRIPTION:		
UNITS:	UG/L	UG/L
DATE SAMPLED:	12/08/88	12/08/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH04 SURFACE WATER

SAMPLE NUMBER:			SH04-SW-001-1	SH04-SW-002-1
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:			UG/L	UG/L
DATE SAMPLED:			12/08/88	12/08/88

*** INORGANICS ***

PP	CAS NO	COMPOUND	SH04-SW-001-1	SH04-SW-002-1
2		ANTIMONY		J 55.5

SHEPPARD AFB (PHASE I) SH04 SURFACE WATER

SAMPLE NUMBER:		SH04-SW-001-1	SH04-SW-002-1
DILUTION FACTOR:			
DESCRIPTION:			
UNITS:		MG/L	MG/L
DATE SAMPLED:		12/08/88	12/08/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH04-SW-001-1	SH04-SW-002-1
		CHLORIDE	78.1	160.0
		NITRATE (as N)		0.81
		SULFATE	49.2	72.8
		TDS	437	632
		FLUORIDE	1.1	1.4
		BROMIDE	2.9	0.91
		PHOSPHATE, TOTAL UG/L	34.8	57.6

BLANKS

SHEPPARD AFB (PHASE I) SH02 TRIP BLANK

SAMPLE NUMBER:	SH02-TB-NOV08-X
DILUTION FACTOR:	1.0
DESCRIPTION:	TRIP BLANK
UNITS:	UG/L
DATE SAMPLED:	11/08/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH02 TRIP BLANK

SAMPLE NUMBER:	SH02-TB-NOV08-X
DILUTION FACTOR:	
DESCRIPTION:	TRIP BLANK
UNITS:	UG/L
DATE SAMPLED:	11/08/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

339

SHEPPARD AFB (PHASE I) SH02 TRIP BLANK

SAMPLE NUMBER:	SH02-TB-NOV08-X
DILUTION FACTOR:	
DESCRIPTION:	TRIP BLANK
UNITS:	UG/L
DATE SAMPLED:	11/08/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

340

SHEPPARD AFB (PHASE I) SH02 TRIP BLANK

SAMPLE NUMBER:	SH02-TB-NOV08-X
DILUTION FACTOR:	
DESCRIPTION:	TRIP BLANK
UNITS:	UG/L
DATE SAMPLED:	11/08/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

341

SHEPPARD AFB (PHASE I) SH02 TRIP BLANK

SAMPLE NUMBER:	SH02-TB-NOV08-X
DILUTION FACTOR:	
DESCRIPTION:	TRIP BLANK
UNITS:	
DATE SAMPLED:	11/08/88

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

342

SHEPPARD AFB (PHASE I) SH02 TRIP BLANK

SAMPLE NUMBER:	SH02-TB-NOV08-X
DILUTION FACTOR:	
DESCRIPTION:	TRIP BLANK
UNITS:	
DATE SAMPLED:	11/08/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

373

SHEPPARD AFB (PHASE I) SH04 RINSATE BLANK

SAMPLE NUMBER:	SH04-RB-DEC12-X
DILUTION FACTOR:	1
DESCRIPTION:	RINSATE BLK
UNITS:	UG/L
DATE SAMPLED:	12/12/88

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

344

SHEPPARD AFB (PHASE I) SH04 RINSATE BLANK

SAMPLE NUMBER:	SH04-RB-DEC12-X
DILUTION FACTOR:	1
DESCRIPTION:	RINSATE BLK
UNITS:	UG/L
DATE SAMPLED:	12/12/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

345

SHEPPARD AFB (PHASE I) SH04 RINSATE BLANK

SAMPLE NUMBER:	SH04-RB-DEC12-X
DILUTION FACTOR:	1
DESCRIPTION:	RINSATE BLK
UNITS:	UG/L
DATE SAMPLED:	12/12/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

346

SHEPPARD AFB (PHASE I) SH04 RINSATE BLANK

SAMPLE NUMBER:	SH04-RB-DEC12-X
DILUTION FACTOR:	1
DESCRIPTION:	RINSATE BLK
UNITS:	UG/L
DATE SAMPLED:	12/12/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

347

SHEPPARD AFB (PHASE I) SH04 RINSATE BLANK

SAMPLE NUMBER:	SH04-RB-DEC12-X
DILUTION FACTOR:	
DESCRIPTION:	RINSATE BLK
UNITS:	UG/L
DATE SAMPLED:	12/12/88

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

348

SHEPPARD AFB (PHASE I) SH04 RINSATE BLANK

SAMPLE NUMBER:	SH04-RB-DEC12-X
DILUTION FACTOR:	
DESCRIPTION:	RINSATE BLK
UNITS:	
DATE SAMPLED:	12/12/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-FB-182-02	SH00-FB-DEC09-X	SH00-FB-DEC18-X	SH00-FB-DEC18-Y	SH00-FB-DEC20-X	SH00-FB-NOV13-X	SH00-FB-NOV13-Y
DILUTION FACTOR:	1	5	1	1	1	1.0	1.0
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/09/88	12/09/88	12/18/88	12/18/88	12/20/88	11/13/88	11/13/88

*** VOLATILES ***

PP	CAS NO	COMPOUND	SH00-FB-182-02	SH00-FB-DEC09-X	SH00-FB-DEC18-X	SH00-FB-DEC18-Y	SH00-FB-DEC20-X	SH00-FB-NOV13-X	SH00-FB-NOV13-Y
	67-64-1	ACETONE	350	860			15		
4V	71-43-2	BENZENE							
86V	108-88-3	TOLUENE	57		3J	3J			40
87V	79-01-6	TRICHLOROETHENE				2J			
23V	67-66-3	CHLOROFORM				3J			
44V	75-09-2	METHYLENE CHLORIDE	150	130	8	7	5		J 200
46V	74-83-9	BROMOMETHANE							

350

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-182-02	SHOO-FB-DEC09-X	SHOO-FB-DEC18-X	SHOO-FB-DEC18-Y	SHOO-FB-DEC20-X	SHOO-FB-NOV13-X	SHOO-FB-NOV13-Y
DILUTION FACTOR:		1	1	1	1		
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/09/88	12/09/88	12/18/88	12/18/88	12/20/88	11/13/88	11/13/88
*** BASE/NEUTRALS ***							
PP CAS NO COMPOUND							
66B 117-81-7 BIS(2-ETHYLHEXYL)PHTHALATE		10					
67B 85-68-7 BUTYL BENZYL PHTHALATE							

351

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-182-02	SHOO-FB-DEC09-X	SHOO-FB-DEC18-X	SHOO-FB-DEC18-Y	SHOO-FB-DEC20-X	SHOO-FB-NOV13-X	SHOO-FB-NOV13-Y
DILUTION FACTOR:		1	1	1	1		
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/09/88	12/09/88	12/18/88	12/18/88	12/20/88	11/13/88	11/13/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

352

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-182-02	SHOO-FB-DEC09-X	SHOO-FB-DEC18-X	SHOO-FB-DEC18-Y	SHOO-FB-DEC20-X	SHOO-FB-NOV13-X	SHOO-FB-NOV13-Y
DILUTION FACTOR:		1		1	1	1.0	1.0
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/09/88	12/09/88	12/18/88	12/18/88	12/20/88	11/13/88	11/13/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

353

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-182-02	SHOO-FB-DEC09-X	SHOO-FB-DEC18-X	SHOO-FB-DEC18-Y	SHOO-FB-DEC20-X	SHOO-FB-NOV13-X	SHOO-FB-NOV13-Y
DILUTION FACTOR:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
UNITS:		UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/09/88	12/09/88	12/18/88	12/18/88	12/20/88	11/13/88	11/13/88

*** INORGANICS ***

PP	CAS NO	COMPOUND
6		CADMIUM
8		CHROMIUM
18		SELENIUM
24		ZINC

354

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-182-02	SHOO-FB-DEC09-X	SHOO-FB-DEC18-X	SHOO-FB-DEC18-Y	SHOO-FB-DEC20-X	SHOO-FB-NOV13-X	SHOO-FB-NOV13-Y
DILUTION FACTOR:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
UNITS:			MG/L		MG/L		
DATE SAMPLED:	12/09/88	12/09/88	12/18/88	12/18/88	12/20/88	11/13/88	11/13/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SHOO-FB-182-02	SHOO-FB-DEC09-X	SHOO-FB-DEC18-X	SHOO-FB-DEC18-Y	SHOO-FB-DEC20-X	SHOO-FB-NOV13-X	SHOO-FB-NOV13-Y
		TDS			15				
		GAMMA EMITTERS CS 137 (pCi/g)			-	4.9±1.2			
		GROSS BETA (pCi/g)			47±5				

SHEPPARD AFB (PHASE I) SH00 BLANKS

			SH00-RB-DEC06-X	SH00-RB-DEC07-X	SH00-RB-DEC08-X	SH00-RB-DEC18-X	SH00-RB-DEC19-X	SH00-RB-DEC20-X	SH00-RB-NOV08-X
SAMPLE NUMBER:			SH00-RB-DEC06-X	SH00-RB-DEC07-X	SH00-RB-DEC08-X	SH00-RB-DEC18-X	SH00-RB-DEC19-X	SH00-RB-DEC20-X	SH00-RB-NOV08-X
DILUTION FACTOR:			1	1	1	1	1	1	1.0
DESCRIPTION:			RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/06/88	12/07/88	12/08/88	12/18/88	12/19/88	12/20/88	11/09/88
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE	42		330	72			
4V	71-43-2	BENZENE					2J		
86V	108-88-3	TOLUENE	5				3J		
87V	79-01-6	TRICHLOROETHENE							
23V	67-66-3	CHLOROFORM					4J		
44V	75-09-2	METHYLENE CHLORIDE	12	120	87	23	21	6	
46V	74-83-9	BROMOMETHANE					2J		

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:		SHOO-RB-DEC06-X	SHOO-RB-DEC07-X	SHOO-RB-DEC08-X	SHOO-RB-DEC18-X	SHOO-RB-DEC19-X	SHOO-RB-DEC20-X	SHOO-RB-NOV08-X
DILUTION FACTOR:		1	1	1	1		1	
DESCRIPTION:		RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:		UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:		12/06/88	12/07/88	12/08/88	12/18/88	12/19/88	12/20/88	11/09/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	SHOO-RB-DEC06-X	SHOO-RB-DEC07-X	SHOO-RB-DEC08-X	SHOO-RB-DEC18-X	SHOO-RB-DEC19-X	SHOO-RB-DEC20-X	SHOO-RB-NOV08-X
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	6		J 100				
67B	85-68-7	BUTYL BENZYL PHTHALATE			J 2				

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-RB-DEC06-X	SHOO-RB-DEC07-X	SHOO-RB-DEC08-X	SHOO-RB-DEC18-X	SHOO-RB-DEC19-X	SHOO-RB-DEC20-X	SHOO-RB-NOV08-X
DILUTION FACTOR:	1	1	1	1		1	
DESCRIPTION:	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/06/88	12/07/88	12/08/88	12/18/88	12/19/88	12/20/88	11/09/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-RB-DEC06-X	SHOO-RB-DEC07-X	SHOO-RB-DEC08-X	SHOO-RB-DEC18-X	SHOO-RB-DEC19-X	SHOO-RB-DEC20-X	SHOO-RB-NOV08-X
DILUTION FACTOR:	1	1	1	1		1	1.0
DESCRIPTION:	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/06/88	12/07/88	12/08/88	12/18/88	12/19/88	12/20/88	11/09/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

359

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:			SH00-RB-DEC06-X	SH00-RB-DEC07-X	SH00-RB-DEC08-X	SH00-RB-DEC18-X	SH00-RB-DEC19-X	SH00-RB-DEC20-X	SH00-RB-NOV08-X
DILUTION FACTOR:									
DESCRIPTION:			RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:			UG/L	UG/L	UG/L	UG/L		UG/L	UG/L
DATE SAMPLED:			12/06/88	12/07/88	12/08/88	12/18/88	12/19/88	12/20/88	11/09/88
*** INORGANICS ***									
PP	CAS NO	COMPOUND							
6		CADMIUM							
8		CHROMIUM							
18		SELENIUM				2.64			
24		ZINC							

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:			SH00-RB-DEC06-X	SH00-RB-DEC07-X	SH00-RB-DEC08-X	SH00-RB-DEC18-X	SH00-RB-DEC19-X	SH00-RB-DEC20-X	SH00-RB-NOV08-X
DILUTION FACTOR:									
DESCRIPTION:			RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:								MG/L	
DATE SAMPLED:			12/06/88	12/07/88	12/08/88	12/18/88	12/19/88	12/20/88	11/09/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	SH00-RB-DEC06-X	SH00-RB-DEC07-X	SH00-RB-DEC08-X	SH00-RB-DEC18-X	SH00-RB-DEC19-X	SH00-RB-DEC20-X	SH00-RB-NOV08-X
		TDS						8	
		GAMMA EMITTERS CS 137 (pCi/g)				-			
		GROSS BETA (pCi/g)							

361

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:			SH00-RB-NOV10-X	SH00-RB-NOV12-X	SH00-RB-NOV15-X	SH00-RB-NOV17-X	SH00-RB-NOV19-X	SH00-TB-DEC07-X	SH00-TB-DEC09-X
DILUTION FACTOR:			1.0	1.0	1.0	1.0	1.0	1	1
DESCRIPTION:			RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	TRIP BLANK	TRIP BLANK
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			11/10/88	11/12/88	11/15/88	11/17/88	11/19/88	12/07/88	12/09/88
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE				J 11			
4V	71-43-2	BENZENE							
86V	108-88-3	TOLUENE							
87V	79-01-6	TRICHLOROETHENE							
23V	67-66-3	CHLOROFORM				J 1	J 2		
44V	75-09-2	METHYLENE CHLORIDE						10	9
46V	74-83-9	BROMOMETHANE							

SHEPPARD AFB (PHASE I) SHOO BLANKS

	SHOO-RB-NOV10-X	SHOO-RB-NOV12-X	SHOO-RB-NOV15-X	SHOO-RB-NOV17-X	SHOO-RB-NOV19-X	SHOO-TB-DEC07-X	SHOO-TB-DEC09-X
SAMPLE NUMBER:	SHOO-RB-NOV10-X	SHOO-RB-NOV12-X	SHOO-RB-NOV15-X	SHOO-RB-NOV17-X	SHOO-RB-NOV19-X	SHOO-TB-DEC07-X	SHOO-TB-DEC09-X
DILUTION FACTOR:							
DESCRIPTION:	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/10/88	11/12/88	11/15/88	11/17/88	11/19/88	12/07/88	12/09/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE
67B	85-68-7	BUTYL BENZYL PHTHALATE

363

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-RB-NOV10-X	SHOO-RB-NOV12-X	SHOO-RB-NOV15-X	SHOO-RB-NOV17-X	SHOO-RB-NOV19-X	SHOO-TB-DEC07-X	SHOO-TB-DEC09-X
DILUTION FACTOR:							
DESCRIPTION:	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/10/88	11/12/88	11/15/88	11/17/88	11/19/88	12/07/88	12/09/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

364

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-RB-NOV10-X	SHOO-RB-NOV12-X	SHOO-RB-NOV15-X	SHOO-RB-NOV17-X	SHOO-RB-NOV19-X	SHOO-TB-DEC07-X	SHOO-TB-DEC09-X
DILUTION FACTOR:		1.0	1.0	1.0			
DESCRIPTION:	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/10/88	11/12/88	11/15/88	11/17/88	11/19/88	12/07/88	12/09/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

365

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:			SHOO-RB-NOV10-X	SHOO-RB-NOV12-X	SHOO-RB-NOV15-X	SHOO-RB-NOV17-X	SHOO-RB-NOV19-X	SHOO-TB-DEC07-X	SHOO-TB-DEC09-X
DILUTION FACTOR:									
DESCRIPTION:			RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	TRIP BLANK	TRIP BLANK
UNITS:				UG/L	UG/L	UG/L			
DATE SAMPLED:			11/10/88	11/12/88	11/15/88	11/17/88	11/19/88	12/07/88	12/09/88
*** INORGANICS ***									
PP	CAS NO	COMPOUND							
6		CADMIUM		J 29					
8		CHROMIUM		23					
18		SELENIUM							
24		ZINC		1761					

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-RB-NOV10-X	SHOO-RB-NOV12-X	SHOO-RB-NOV15-X	SHOO-RB-NOV17-X	SHOO-RB-NOV19-X	SHOO-TB-DEC07-X	SHOO-TB-DEC09-X
DILUTION FACTOR:							
DESCRIPTION:	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L						
DATE SAMPLED:	11/10/88	11/12/88	11/15/88	11/17/88	11/19/88	12/07/88	12/09/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND
		TDS
		GAMMA EMITTERS CS 137 (pCi/g)
		GROSS BETA (pCi/g)

367

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:			SHOO-TB-DEC18-X	SHOO-TB-DEC18-Y	SHOO-TB-DEC18-Z	SHOO-TB-DEC19-Y	SHOO-TB-DEC20-X	SHOO-TB-DEC20-Y	SHOO-TB-NOV11-X
DILUTION FACTOR:			1	1	1	1	1	1	1.0
DESCRIPTION:			TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/28/88	12/18/88	12/18/88	12/19/88	12/20/88	12/20/88	11/11/88
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE					11	13	
4V	71-43-2	BENZENE							
86V	108-88-3	TOLUENE							
87V	79-01-6	TRICHLOROETHENE							
23V	67-66-3	CHLOROFORM							
44V	75-09-2	METHYLENE CHLORIDE	6				4J	5	
46V	74-83-9	BROMOMETHANE							

368

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-DEC18-X	SH00-TB-DEC18-Y	SH00-TB-DEC18-Z	SH00-TB-DEC19-Y	SH00-TB-DEC20-X	SH00-TB-DEC20-Y	SH00-TB-NOV11-X
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/28/88	12/18/88	12/18/88	12/19/88	12/20/88	12/20/88	11/11/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE
67B	85-68-7	BUTYL BENZYL PHTHALATE

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-DEC18-X	SHOO-TB-DEC18-Y	SHOO-TB-DEC18-Z	SHOO-TB-DEC19-Y	SHOO-TB-DEC20-X	SHOO-TB-DEC20-Y	SHOO-TB-NOV11-X
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/28/88	12/18/88	12/18/88	12/19/88	12/20/88	12/20/88	11/11/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

370

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-DEC18-X	SH00-TB-DEC18-Y	SH00-TB-DEC18-Z	SH00-TB-DEC19-Y	SH00-TB-DEC20-X	SH00-TB-DEC20-Y	SH00-TB-NOV11-X
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/28/88	12/18/88	12/18/88	12/19/88	12/20/88	12/20/88	11/11/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

371

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-DEC18-X	SH00-TB-DEC18-Y	SH00-TB-DEC18-Z	SH00-TB-DEC19-Y	SH00-TB-DEC20-X	SH00-TB-DEC20-Y	SH00-TB-NOV11-X
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:							
DATE SAMPLED:	12/18/88	12/18/88	12/18/88	12/19/88	12/20/88	12/20/88	11/11/88

*** INORGANICS ***

PP	CAS NO	COMPOUND
6		CADMIUM
8		CHROMIUM
18		SELENIUM
24		ZINC

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-DEC18-X	SHOO-TB-DEC18-Y	SHOO-TB-DEC18-Z	SHOO-TB-DEC19-Y	SHOO-TB-DEC20-X	SHOO-TB-DEC20-Y	SHOO-TB-NOV11-X
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:							
DATE SAMPLED:	12/18/88	12/18/88	12/18/88	12/19/88	12/20/88	12/20/88	11/11/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND
		TDS
		GAMMA EMITTERS CS 137 (pCi/g)
		GROSS BETA (pCi/g)

373

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-NOV12-X	SH00-TB-NOV13-X	SH00-TB-NOV13-Y	SH00-TB-NOV15-X	SH00-TB-NOV15-Y	SH00-TB-NOV17-X	SH00-TB-NOV18-Y
DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/12/88	11/13/88	11/13/88	11/15/88	11/15/88	11/17/88	11/18/88

*** VOLATILES ***

PP	CAS NO	COMPOUND
	67-64-1	ACETONE
4V	71-43-2	BENZENE
86V	108-88-3	TOLUENE
87V	79-01-6	TRICHLOROETHENE
23V	67-66-3	CHLOROFORM
44V	75-09-2	METHYLENE CHLORIDE
46V	74-83-9	BROMOMETHANE

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-NOV12-X	SH00-TB-NOV13-X	SH00-TB-NOV13-Y	SH00-TB-NOV15-X	SH00-TB-NOV15-Y	SH00-TB-NOV17-X	SH00-TB-NOV18-Y
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/12/88	11/13/88	11/13/88	11/15/88	11/15/88	11/17/88	11/18/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE
67B	85-68-7	BUTYL BENZYL PHTHALATE

375

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-NOV12-X	SHOO-TB-NOV13-X	SHOO-TB-NOV13-Y	SHOO-TB-NOV15-X	SHOO-TB-NOV15-Y	SHOO-TB-NOV17-X	SHOO-TB-NOV18-Y
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/12/88	11/13/88	11/13/88	11/15/88	11/15/88	11/17/88	11/18/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

376

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-NOV12-X	SH00-TB-NOV13-X	SH00-TB-NOV13-Y	SH00-TB-NOV15-X	SH00-TB-NOV15-Y	SH00-TB-NOV17-X	SH00-TB-NOV18-Y
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	11/12/88	11/13/88	11/13/88	11/15/88	11/15/88	11/17/88	11/18/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-NOV12-X	SH00-TB-NOV13-X	SH00-TB-NOV13-Y	SH00-TB-NOV15-X	SH00-TB-NOV15-Y	SH00-TB-NOV17-X	SH00-TB-NOV18-Y
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:						TRIP BLANK	TRIP BLANK
DATE SAMPLED:	11/12/88	11/13/88	11/13/88	11/15/88	11/15/88	11/17/88	11/18/88

*** INORGANICS ***

PP	CAS NO	COMPOUND
6		CADMIUM
8		CHROMIUM
18		SELENIUM
24		ZINC

378

SHEPPARD AFB (PHASE I) SHOO BLANKS

	SH00-TB-NOV12-X	SH00-TB-NOV13-X	SH00-TB-NOV13-Y	SH00-TB-NOV15-X	SH00-TB-NOV15-Y	SH00-TB-NOV17-X	SH00-TB-NOV18-Y
SAMPLE NUMBER:	SH00-TB-NOV12-X	SH00-TB-NOV13-X	SH00-TB-NOV13-Y	SH00-TB-NOV15-X	SH00-TB-NOV15-Y	SH00-TB-NOV17-X	SH00-TB-NOV18-Y
DILUTION FACTOR:							
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:							
DATE SAMPLED:	11/12/88	11/13/88	11/13/88	11/15/88	11/15/88	11/17/88	11/18/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND
		TDS
		GAMMA EMITTERS CS 137 (pCi/g)
		GROSS BETA (pCi/g)

379

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:		SHOO-TB-NOV19-X	SHOO-TB-NOV19-Y	SHOO-TB-NOV19-Z
DILUTION FACTOR:		1.0	1.0	1.0
DESCRIPTION:		TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:		UG/L	UG/L	UG/L
DATE SAMPLED:		11/19/88	11/19/88	11/19/88

*** VOLATILES ***

PP	CAS NO	COMPOUND
	67-64-1	ACETONE
4V	71-43-2	BENZENE
86V	108-88-3	TOLUENE
87V	79-01-6	TRICHLOROETHENE
23V	67-66-3	CHLOROFORM
44V	75-09-2	METHYLENE CHLORIDE
46V	74-83-9	BROMOMETHANE

380

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-NOV19-X	SHOO-TB-NOV19-Y	SHOO-TB-NOV19-Z
DILUTION FACTOR:			
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	11/19/88

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE
67B	85-68-7	BUTYL BENZYL PHTHALATE

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-NOV19-X	SHOO-TB-NOV19-Y	SHOO-TB-NOV19-Z
DILUTION FACTOR:			
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	11/19/88

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

382

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-NOV19-X	SHOO-TB-NOV19-Y	SHOO-TB-NOV19-Z
DILUTION FACTOR:			
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L
DATE SAMPLED:	11/19/88	11/19/88	11/19/88

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

383

SHEPPARD AFB (PHASE I) SHOO BLANKS

SAMPLE NUMBER:		SHOO-TB-NOV19-X	SHOO-TB-NOV19-Y	SHOO-TB-NOV19-Z
DILUTION FACTOR:				
DESCRIPTION:		TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:				
DATE SAMPLED:		11/19/88	11/19/88	11/19/88

*** INORGANICS ***

PP	CAS NO	COMPOUND
6		CADMIUM
8		CHROMIUM
18		SELENIUM
24		ZINC

384

SHEPPARD AFB (PHASE I) SH00 BLANKS

SAMPLE NUMBER:	SH00-TB-NOV19-X	SH00-TB-NOV19-Y	SH00-TB-NOV19-Z
DILUTION FACTOR:			
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			
DATE SAMPLED:	11/19/88	11/19/88	11/19/88

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND
		TDS
		GAMMA EMITTERS CS 137 (pCi/g)
		GROSS BETA (pCi/g)

385

SHEPPARD AFB (PHASE II) SHOO BLANKS

			SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
SAMPLE NUMBER:			SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
DILUTION FACTOR:			1.0	NA	1.0		1.0		1.0
DESCRIPTION:			RINSATE BLK		RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:			UG/L		UG/L	UG/KG	UG/KG	UG/L	UG/L
DATE SAMPLED:			07/14/89	07/12/89	07/14/89	07/15/89	07/16/89	07/18/89	07/18/89
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE	4		6		17		8
86V	108-88-3	TOLUENE	1J		1J				
23V	67-66-3	CHLOROFORM							2J
44V	75-09-2	METHYLENE CHLORIDE	4		5		5		1

386

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:			SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
DILUTION FACTOR:			1.0	NA	1.0	1.0			1.0
DESCRIPTION:			RINSATE BLK		RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:			UG/L		UG/L	UG/KG	UG/KG	UG/L	UG/L
DATE SAMPLED:			07/14/89	07/12/89	07/14/89	07/15/89	07/16/89	07/18/89	07/18/89
*** BASE/NEUTRALS ***									
PP	CAS NO	COMPOUND							
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	18		180				

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
DILUTION FACTOR:	1.0	NA	1.0	1.0			1.0
DESCRIPTION:	RINSATE BLK		RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:	UG/L		UG/L	UG/KG	UG/KG	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/12/89	07/14/89	07/15/89	07/16/89	07/18/89	07/18/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

388

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
DILUTION FACTOR:	1.0	NA	1.0	1.0		1.0	
DESCRIPTION:	RINSATE BLK		RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK	RINSATE BLK
UNITS:	UG/L		UG/L	UG/KG	UG/KG	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/12/89	07/14/89	07/15/89	07/16/89	07/18/89	07/18/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

389

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
DILUTION FACTOR:		NA					
DESCRIPTION:	FIELD BLANK		RINSATE BLK				RINSATE BLK
UNITS:	UG/L		UG/L	MG/KG			UG/L
DATE SAMPLED:	07/14/89	07/12/89	07/14/89	07/15/89	07/16/89	07/18/89	07/18/89

*** INORGANICS ***

PP	CAS NO	COMPOUND	SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
10		COPPER							[13.0]
12		LEAD							47.0
24		ZINC	15.0		21.0				18.0

390

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-FB-JUL14Y	SHOO-RB-JUL12X	SHOO-RB-JUL14X	SHOO-RB-JUL15X	SHOO-RB-JUL16X	SHOO-RB-JUL182	SHOO-RB-JUL18X
DILUTION FACTOR:							
DESCRIPTION:							
UNITS:							
DATE SAMPLED:	07/14/89	07/12/89	07/14/89	07/15/89	07/16/89	07/18/89	07/18/89
*** GEOCHEMICAL PARAMETERS ***							
PP CAS NO COMPOUND							
RADIUM 226 (pCi/L)		0.4±0.1					

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:			SHOO-TB-JUL142	SHOO-TB-JUL172	SHOO-TB-JUL182	SHOO-TB-JUL192
DILUTION FACTOR:			1.0	1.0	1.0	1.0
DESCRIPTION:			TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			07/14/89	07/17/89	07/18/89	07/19/89
*** VOLATILES ***						
PP	CAS NO	COMPOUND				
	67-64-1	ACETONE	3	10	17	7
86V	108-88-3	TOLUENE	1J			
23V	67-66-3	CHLOROFORM				3J
44V	75-09-2	METHYLENE CHLORIDE	5	8	10	11

SHEPPARD AFB (PHASE II) SHOO BLANKS

	SHOO-TB-JUL142	SHOO-TB-JUL172	SHOO-TB-JUL182	SHOO-TB-JUL192
SAMPLE NUMBER:	SHOO-TB-JUL142	SHOO-TB-JUL172	SHOO-TB-JUL182	SHOO-TB-JUL192
DILUTION FACTOR:				
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/18/89	07/19/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE

393

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-JUL142	SHOO-TB-JUL172	SHOO-TB-JUL182	SHOO-TB-JUL192
DILUTION FACTOR:				
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/18/89	07/19/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

394

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-JUL142	SHOO-TB-JUL172	SHOO-TB-JUL182	SHOO-TB-JUL192
DILUTION FACTOR:				
DESCRIPTION:	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	07/14/89	07/17/89	07/18/89	07/19/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS DETECTED FOR THIS CATEGORY

395

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-JUL142	SHOO-TB-JUL172	SHOO-TB-JUL182	SHOO-TB-JUL192
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	07/14/89	07/17/89	07/18/89	07/19/89

*** INORGANICS ***

PP	CAS NO	COMPOUND
10		COPPER
12		LEAD
24		ZINC

396

SHEPPARD AFB (PHASE II) SHOO BLANKS

SAMPLE NUMBER:	SHOO-TB-JUL142	SHOO-TB-JUL172	SHOO-TB-JUL182	SHOO-TB-JUL192
DILUTION FACTOR:				
DESCRIPTION:				
UNITS:				
DATE SAMPLED:	07/14/89	07/17/89	07/18/89	07/19/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND				
		RADIUM 226 (pCi/L)				

397

H

APPENDIX H

RISK ASSESSMENT CALCULATIONS

NUS CORPORATION AND SUBSIDIARIES	STANDARD CALCULATION SHEET

Sheppard Air Force Base	FILE NO.: 7863	BY: L.A. Sinagoga	PAGE 1 OF 5
SUBJECT: Surface Soil Exposures - Residential Setting		CHECKED BY: DMZ	DATE: 3/30/90

- Exposure through soil ingestion, inhalation and dermal contact are considered.
- Purpose: To determine exposure doses and risks resulting from exposure to contaminants in surface soils and household dusts derived from surface soils

Doses are derived using the following general expression:

$$\underset{(mg/Kg/day)}{Dose} = \frac{ER \times AF \times C_s}{BW} = \frac{(mg/day) \times (mg/Kg) \times \frac{Kg}{10^6 mg}}{Kg}$$

Where:

Dose = contaminant intake (mg/Kg/day)

ER = exposure rate (mg/day)

AF = absorption fraction (decimal fraction)

C_s = contaminant concentration in soil (mg/Kg)

Note: Exposure time frames are also considered in the calculation of the carcinogenic dose.

The exposure rates, absorption fractions, intake rates, exposure durations, and annual average dose predicted by the Hawley Model are presented on Table I.

Reference: Assessment of Health Risk from Exposure to Contaminated Soil
John K. Hawley
Risk Analysis Vol 5, No 4. 1985

These values are used in the exposure dose expressions presented on pages 3 through 6.

NUS CORPORATION AND SUBSIDIARIES | SHEET

CLIENT: Sheppard AFB	FILE NO.: 7863	BY: L.A.Smagoga	PAGE 2 OF
SUBJECT: Routine Exposure to Surface Soil - Residential Setting		CHECKED BY: JMZ	DATE: 3/30/90

	Route of Exposure	Expos Rate (mg/day)	Absorp. Fraction	Contam. Conc (mg/Kg)	Frac of week	Frac of year	Body Weight (Kg)	Annual Avg D (mg/K
2.5 yr old	Outdoors - Oral	250	1	C_s	5/7	1/2	13.2	6.8 C
	(May-Oct) - Dermal	1100	0.018	C_s	5/7	1/2	13.2	0.54 C
	Inhalation	0.13	0.75	C_s	5/7	1/2	13.2	0.003
	Indoors - Oral	50	1	$0.8C_s$	1	1/2	13.2	$1.5C_s$
	- Dermal	28	0.018	$0.8C_s$	1	1	13.2	0.03C
	Inhalation	0.15	0.75	$0.8C_s$	1	1/2	13.2	0.00
	Indoors - Oral	100	1	$0.8C_s$	1	1/2	13.2	3.0C
	Inhalation	0.34	0.75	$0.8C_s$	1	1/2	13.2	0.008C
								12C
6 yr old	Outdoors - Oral	50	1	C_s	1	5/12	20.8	1.0 C_s
	(May-Sept) Dermal	800	0.018	C_s	1	5/12	20.8	0.38
	Inhalation	0.12	0.75	C_s	1	5/12	20.8	[illegible]
	Indoors - Oral	3	1	$0.8C_s$	1	1	20.8	0.11C
	- Dermal	22	0.006	$0.8C_s$	1	1	20.8	0.005
	Inhalation	✓ 0.31	0.75	$0.8C_s$	1	1	20.8	0.009
								$1.4C_s$
Adult	Attics: Oral	110	1	$0.8C_s$	(1)	12/365	70	0.042
	Dermal$_1$	3100	0.003	$0.8C_s$	(1)	12/365	70	0.003
	Dermal$_2$	110	0.003	$0.8C_s$	(1)	12/365	70	0.000
	Inhale	20	0.75	$0.8C_s$	(1)	12/365	70	0.006
	Liv Space: Oral	0.56	1	$0.8C_s$	✓ (1)	1	70	0.00
	Dermal	51	0.009	$0.8C_s$	1	1	70	0.00
	Inhale	0.81	0.75	$0.8C_s$	1	1	70	0.00
	Outdoors - Oral	480	1	C_s	2/7	5/12	70	0.81C
	May-Sept Dermal	6400	0.006	C_s	2/7	5/12	70	0.06
	Inhale	0.27	0.75	C_s	2/7	5/12	70	0.00
								0.94

Source: Hawley, J.K., 1985. "Assessment of Health Risks from Exposure to Contaminated Soils" Risk Analysis, Vol 5, No 4, 1985

NUS 1584 REVISED 0285

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Sheppard AFB	FILE NO.: 7863	BY: L.A. Siragosa	PAGE 3 OF 5
SUBJECT: Surface Soil Exposures - Residential Setting		CHECKED BY: JMZ	DATE: 3/30/90

Calculation of Noncarcinogenic Dose:

Accidental Ingestion Exposure Scenario:

$$\text{Exposure Dose} = \frac{C_s \times IR \times AF}{BW}$$

where: C_s = Soil concentration (mg/k
IR = Ingestion Rate (mg/d)
AF = Absorption Fraction
BW = Body Weight (Kg)

Exposure Dose for a 13.2 Kg child:

$$= \frac{(C_s\ mg/Kg) \times 200\ mg/d \times 1 \times \frac{1\ Kg}{10^6\ mg}}{13.2\ Kg} = C_s\ mg/Kg \times \underline{\underline{1.515e^{-5}}}$$

Exposure Dose for a 70 Kg adult:

$$= \frac{(C_s\ mg/Kg) \times 590\ mg/d \times 1 \times \frac{1\ Kg}{10^6\ mg}}{70\ Kg} = C_s\ mg/Kg \times \underline{\underline{8.429 \times 10^{-6}}}$$

Inhalation of Dusts/Soils Exposure Scenario:

$$\text{Exposure Dose} = \frac{C_s \times IR \times AF}{BW}$$

where: C_s = Soil Concentration (mg
IR = Inhalation Rate (mg/d
AF = Absorption Fraction
BW = Body Weight (Kg)

Exposure Dose for a 13.2 Kg child:

$$= \frac{C_s(mg/Kg) \times 0.28\ mg/d \times 0.75 \times \frac{1\ Kg}{10^6\ mg}}{13.2\ Kg} = C_s\ mg/Kg \times \underline{\underline{1.591 \times 10^{-8}}}$$

Exposure Dose for a 70 Kg adult:

$$= \frac{(C_s\ mg/Kg) \times 21\ mg/d \times 0.75 \times \frac{1\ Kg}{10^6\ mg}}{70\ Kg} = C_s\ mg/Kg \times \underline{\underline{2.25 \times 10^{-7}}}$$

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: Sheppard Air Force Base	FILE NO.: 7863	BY: L.A. Sinagoga	PAGE 4 OF 5
SUBJECT: Surface Soil Exposures - Residential Setting		CHECKED BY: DMZ	DATE: 3/30/90

Calculation of Noncarcinogenic Dose -- continued

Dermal Contact w/ Dust-Soils Exposure Scenario:

$$\text{Exposure Dose} = \frac{C_s \times CR \times AF}{BW}$$

where: C_s = Soil Concentration (mg/Kg)
CR = Contact Rate (mg/d)
AF = Absorption Fraction
BW = Body Weight (Kg)

Exposure Dose for a 13.2 Kg child:

$$= \frac{C_s\,(mg/Kg) \times 1128\,mg/d \times 0.018 \times \frac{1\,Kg}{10^6\,mg}}{13.2\,Kg} = C_s\,(mg/Kg) \times 1.538 \times 10^{-6}$$

Exposure Dose for a 70 Kg adult:

$$= \frac{C_s\,(mg/Kg) \times 9661\,mg/d \times 0.009 \times \frac{1\,Kg}{10^6\,mg}}{70\,Kg} = C_s\,(mg/Kg) \times 1.242 \times 10^{-6}$$

Calculation of Carcinogenic Dose

(Time Weighted exposure over a lifetime)

Accidental Ingestion Exposure Scenario:

$$\text{Exposure Dose} = C_s\,(\cancel{mg}/Kg) \times \frac{\text{Average Annual Dose}\,\frac{(mg)}{(d)} \times \text{Exposure Duration}\,(\cancel{yr}) \times 1 \times 10}{BW(\cancel{Kg}) \times \text{Lifetime}\,(\cancel{yr})}$$

$$= C_s\,\cancel{mg}/\cancel{Kg}\left[\frac{(6.8+1.5+3.0)\,mg/Kg}{day}\left(\frac{5.5}{70}\right) + \frac{(1.0+0.11)\,\frac{mg}{Kg}}{d}\left(\frac{9}{70}\right) + \frac{(0.042+0.006+0.81)\,\frac{mg}{Kg}}{day}\left(\frac{55}{70}\right)\right] \times \frac{1\,\cancel{Kg}}{10^6\,\cancel{mg}}$$

$$= C_s\,mg/Kg\left[\frac{11.3\,mg/Kg}{d}\left(\frac{5.5}{70}\right) + \frac{1.11\,mg/Kg}{d}\left(\frac{9}{70}\right) + \frac{0.858\,mg/Kg}{d}\left(\frac{55}{70}\right)\right] \times \frac{1\,Kg}{10^6\,mg}$$

$$= C_s\,mg/Kg\left[0.888\,\frac{mg/Kg}{d} + 0.143\,\frac{mg/Kg}{d} + 0.674\,\frac{mg/Kg}{d}\right] \times \frac{1\,Kg}{10^6\,mg} = C_s \times \underline{\underline{1.705 \times 10^{-6}}}$$

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: ~~Sheppard Air Force Base~~	FILE NO.: ~~4863~~	BY: L.A. Sinagoga	PAGE 5 OF 5
SUBJECT: Surface Soil Exposures - Residential Setting		CHECKED BY: DMZ	DATE: 3/30/90

Calculation of Carcinogenic Dose -- continued --

Dermal Contact w/ Dusts - Soils Exposure Scenario

$$\text{Exposure Dose} = C_s(mg/Kg)\left[\frac{(0.54+0.03)\,mg/Kg}{d}\left(\frac{5.5y}{70y}\right)+\frac{(0.28+0.005)\,mg/Kg}{d}\left(\frac{9y}{70y}\right)+\frac{(0.06+0.003+0.0002+0.006)\,mg/Kg}{d}\left(\frac{55y}{70y}\right)\right]$$

$$= C_s(mg/Kg)\left[\frac{0.57\,mg/Kg}{d}\left(\frac{5.5y}{70y}\right)+\frac{0.285\,mg/Kg}{d}\left(\frac{9y}{70y}\right)+\frac{0.0692\,mg/Kg}{d}\left(\frac{55y}{70y}\right)\right]\times\frac{1\,Kg}{10^6\,mg}$$

$$= C_s(mg/Kg)\left[0.0448\frac{mg/Kg}{d}+0.0367\frac{mg/Kg}{d}+0.0544\frac{mg/Kg}{d}\right]\times\frac{1\,Kg}{10^6\,mg}$$

$$= C_s \times 1.35\times10^{-7}$$

Inhalation of Dusts / Soils Exposure Scenario

$$\text{Exposure Dose} = C_s(mg/Kg)\left[\frac{(0.003+0.004+0.008)\,mg/Kg}{d}\left(\frac{5.5y}{70y}\right)+\frac{(0.002+0.009)\,mg/Kg}{d}\left(\frac{9y}{70y}\right)+\frac{(0.006+0.007+0.0003)\,mg/Kg}{d}\right]\times\frac{1\,Kg}{10^6\,mg}$$

$$= C_s(mg/Kg)\left[\frac{(0.015)\,mg/Kg}{d}\left(\frac{5.5y}{70y}\right)+\frac{(0.011)\,mg/Kg}{d}\left(\frac{9y}{70y}\right)+\frac{0.0133\,mg/Kg}{d}\left(\frac{55y}{70y}\right)\right]\times\frac{1\,Kg}{10^6\,mg}$$

$$= C_s(mg/Kg)\left[0.0012\frac{mg/Kg}{d}+0.0014\frac{mg/Kg}{d}+0.01045\frac{mg/Kg}{d}\right]\times\frac{1\,Kg}{10^6\,mg}$$

$$= C_s\times 1.305\times10^{-8}$$

1/5

RISK ANALYSIS RESULTS
SITE 3 LANDFILL 1

SURFACE SOIL EXPOSURES - RESIDENTIAL SETTING
HAWLEY MODEL
MAXIMUM CONTAMINANT LEVELS EVALUATED

CONTAMINANT	CONCENT MG/KG	ACCID IN NONCAN	ACCID IN CANCER	DERMAL NONCAN	DERMAL CANCER	INHAL NONCAN	INHAL CANCER	RfD ORAL	RfD INHAL	CPF ORAL	CPF INHAL	ELCR	HAZARD QUOTIENT
4,4-DDE	0.17	2.58E-06	2.90E-07	2.61E-07	2.30E-08	2.70E-09	2.22E-09			3.40E-01		1.06E-07	0
4,4-DDT	0.085	1.29E-06	1.45E-07	1.31E-07	1.15E-08	1.35E-09	1.11E-09	5.00E-04		3.40E-01		5.32E-08	0.00263696
DIELDRIN	0.15	2.27E-06	2.56E-07	2.31E-07	2.02E-08	2.39E-09	1.96E-09	5.00E-05		1.61E+00	1.60E+01	4.76E-07	0.050064
DELTA-BHC	0.017	2.58E-07	2.90E-08	2.61E-08	2.30E-09	2.70E-10	2.22E-10					0.00E+00	0
CHLORDANE	0.27	4.09E-06	4.60E-07	4.15E-07	3.65E-08	4.30E-09	3.52E-09	6.00E-05		1.30E+00	1.30E+00	6.50E-07	0.075096
HEPTACHLOR	0.2	3.03E-06	3.41E-07	3.08E-07	2.70E-08	3.18E-09	2.61E-09	5.00E-04		4.50E+00	4.50E+00	1.67E-06	0.0066752
												2.95E-06	0.13467216

RISK ANALYSIS RESULTS SHEPPARD AIR FORCE BASE
SITE 3 LANDFILL 1
APRIL 10,1990
SURFACE SOIL EXPOSURES - RESIDENTIAL SETTING
HAWLEY MODEL
ARITHMETIC AVERAGE VALUES - NONDETECTS EQUAL 1/2 CRDL
THE HAZARD INDEX IS CALCULATED FOR A 13.2 KG CHILD
THE EXCESS LIFETIME CANCER RISK IS CALCULATED FOR LIFETIME EXPOSURE

CONTAMINANT	CONCENT MG/KG	ACCID IN NONCAN	ACCID IN CANCER	DERMAL NONCAN	DERMAL CANCER	INHAL NONCAN	INHAL CANCER	RfD ORAL	RfD INHAL	CPF ORAL	CPF INHAL	ELCR	HAZARD QUOTIENT
4.4-DDE	0.084	1.27E-06	1.43E-07	1.29E-07	1.13E-08	1.34E-09	1.10E-09			3.40E-01		5.26E-08	0
4.4-DDT	0.057	8.64E-07	9.72E-08	8.77E-08	7.70E-09	9.07E-10	7.44E-10	5.00E-04		3.40E-01		3.57E-08	0.001502432
DIELDRIN	0.044	6.59E-07	7.42E-08	6.69E-08	5.87E-09	6.92E-10	5.68E-10	5.00E-05		1.61E+00	1.60E+01	1.38E-07	0.01451856
DELTA-BHC	0.007	1.11E-07	1.24E-08	1.12E-08	9.85E-10	1.16E-10	9.53E-11					0.00E+00	0
CHLORDANE	0.113	1.70E-06	1.92E-07	1.73E-07	1.52E-08	1.79E-09	1.47E-09	6.00E-05		1.30E+00	1.30E+00	2.71E-07	0.03129
HEPTACHLOR	0.053	8.03E-07	9.04E-08	8.15E-08	7.16E-09	8.43E-10	6.92E-10	5.00E-04		4.50E+00	4.50E+00	4.42E-07	0.001768928
												9.39E-07	0.04947992

RISK ANALYSIS RESULTS SHEPPARD AIR FORCE BASE
SITE 3 LANDFILL 1
APRIL 10,1990
SURFACE SOIL EXPOSURES - RESIDENTIAL SETTING
HAWLEY MODEL
GEOMETRIC MEAN VALUES - NONDETECTS EQUAL 1/2 CRDL
THE HAZARD INDEX IS CALCULATED FOR A 13.2 KG CHILD
THE EXCESS LIFETIME CANCER RISK IS CALCULATED FOR LIFETIME EXPOSURE

CONTAMINANT	CONCENT MG/KG	ACCID IN NONCAN	ACCID IN CANCER	DERMAL NONCAN	DERMAL CANCER	INHAL NONCAN	INHAL CANCER	RfD ORAL	RfD INHAL	CPF ORAL	CPF INHAL	ELCR	HAZARD QUOTIENT
4.4-DDE	0.064	9.70E-07	1.09E-07	9.24E-08	8.64E-09	1.02E-09	8.35E-10			3.40E-01		4.00E-08	0
4.4-DDT	0.054	8.18E-07	9.21E-08	9.71E-08	7.29E-09	8.59E-10	7.05E-10	5.00E-04		3.40E-01		3.38E-08	0.001802304
DIELDRIN	0.016	2.42E-07	2.73E-08	2.45E-08	2.16E-09	2.55E-10	2.09E-10	5.00E-05		1.61E+01	1.60E+01	5.07E-08	0.00534016
DELTA-BHC	0.005	5.64E-08	9.72E-09	8.77E-09	7.70E-10	9.07E-11	7.44E-11					0.00E+00	0
CHLORDANE	0.081	1.23E-06	1.38E-07	1.15E-07	1.09E-08	1.29E-09	1.06E-09	6.00E-05		1.30E+00	1.30E+00	1.95E-07	0.0225283
HEPTACHLOR	0.011	1.61E-07	1.59E-08	1.63E-08	1.40E-09	1.69E-10	1.38E-10	5.00E-04		4.50E+00	4.50E+00	8.24E-08	0.000353735
												4.02E-07	0.030025047

RISK ANALYSIS RESULTS SHEFFARD AIR FORCE BASE
SITE 3 LANDFILL 1
APRIL 10,1990
SURFACE SOIL EXPOSURES - RESIDENTIAL SETTING
HAWLEY MODEL
AVERAGE CONTAMINANT LEVELS - POSITIVE DETECTIONS ONLY
THE HAZARD INDEX IS CALCULATED FOR A 13.2 KG CHILD
THE EXCESS LIFETIME CANCER RISK IS CALCULATED FOR LIFETIME EXPOSURE

CONTAMINANT	CONCENT MG/KG	ACCID IN NONCAN	ACCID IN CANCER	DERMAL NONCAN	DERMAL CANCER	INHAL NONCAN	INHAL CANCER	RfD ORAL	RfD INHAL	CPF ORAL	CPF INHAL	ELCR	HAZARD QUOTIENT
4,4-DDE	0.08	1.21E-06	1.36E-07	1.23E-07	1.08E-08	1.27E-09	1.04E-09			3.40E-01		5.00E-08	0
4,4-DDT	0.06	9.09E-07	1.02E-07	9.23E-03	8.10E-09	9.55E-10	7.83E-10	5.00E-04		3.40E-01		3.75E-08	0.00200256
DIELDRIN	0.15	2.27E-06	2.56E-07	2.31E-07	2.02E-08	2.39E-09	1.96E-09	5.00E-05		1.61E+00	1.60E+01	4.76E-07	0.050064
DELTA-BHC	0.017	2.58E-07	2.90E-08	2.61E-08	2.30E-09	2.70E-10	2.22E-10					0.00E+00	0
CHLORDANE	0.185	2.80E-06	3.15E-07	2.85E-07	2.50E-08	2.94E-09	2.41E-09	6.00E-05		1.30E+00	1.30E+00	4.46E-07	0.051454666
HEPTACHLOR	0.05	7.59E-07	8.52E-08	7.69E-09	6.75E-09	7.96E-10	6.52E-10	5.00E-04		4.50E+00	4.50E+00	4.17E-07	0.0016688
												1.43E-06	0.105190026

4/5

RISK ANALYSIS RESULTS SHEPPARD AIR FORCE BASE
SITE 3 LANDFILL 1
APRIL 10,1990
SURFACE SOIL EXPOSURES - RESIDENTIAL SETTING
HAWLEY MODEL
AVERAGE CONTAMINANT LEVELS - NON DETECTS EQUAL ZERO
THE HAZARD INDEX IS CALCULATED FOR A 13.2 KG CHILD
THE EXCESS LIFETIME CANCER RISK IS CALCULATED FOR LIFETIME EXPOSURE

CONTAMINANT	CONCENT MG/KG	ACCID IN NONCAN	ACCID IN CANCER	DERMAL NONCAN	DERMAL CANCER	INHAL NONCAN	INHAL CANCER	RfD ORAL	RfD INHAL	CPF ORAL	CPF INHAL	ELCR	HAZARD QUOTIENT
4,4-DDE	0.08	1.21E-06	1.36E-07	1.23E-07	1.08E-08	1.27E-09	1.04E-09			3.40E-01		5.00E-08	0
4,4-DDT	0.06	9.09E-07	1.02E-07	9.23E-08	8.10E-09	9.55E-10	7.83E-10	5.00E-04		3.40E-01		3.75E-08	0.00200256
DIELDRIN	0.04	6.06E-07	6.82E-08	6.15E-09	5.40E-09	6.36E-10	5.22E-10	5.00E-05		1.61E+00	1.60E+01	1.27E-07	0.0133504
DELTA-BHC	0.0043	6.51E-08	7.33E-09	6.61E-09	5.81E-10	6.84E-11	5.61E-11					0.00E+00	0
CHLORDANE	0.09	1.36E-06	1.53E-07	1.38E-07	1.21E-08	1.43E-09	1.17E-09	6.00E-05		1.30E+00	1.30E+00	2.17E-07	0.025032
HEPTACHLOR	0.05	7.58E-07	8.52E-08	7.69E-08	6.75E-09	7.96E-10	6.52E-10	5.00E-04		4.50E+00	4.50E+00	4.17E-07	0.0016688
												8.48E-07	0.04205376

5/5

Appendix H

Risk Analysis Calculations and Results

Industrial Waste Pit Site

Evaluation of Dermal Absorption of

Surface Soil Contaminants

NUS CORPORATION AND SUBSIDIARIES

STANDARD CALCULATION SHEET

CLIENT: Sheppard AFB	FILE NO.: 7863	BY: L.A. Sinagoso	PAGE 1 OF 6
SUBJECT: Dermal Absorption of Surface Soil Contaminants - Industrial Waste Pit		CHECKED BY: DM	DATE: 4/10/90

Purpose: Evaluate carcinogenic/noncarcinogenic health risks associated w/ dermal contact with surface soil contaminants.

Assumptions:
- Surface area exposed equals 10% of human body (i.e. the hands and part of the forearms):
  Surface area of average adult ≅ 18,000 cm²
  Surface area of average child ≅ 9,400 cm²
  (Reference: EPA Superfund Exposure Assessment Manual, EPA/540/1-88/001 - April 1988
- Dust Adherence rate to skin - 2.77 mg/cm²-d (EPA/540/1-88/001)
- Absorped fraction for pesticides - 0.05
  (Reference: Supplemental Risk Assessment Guidance for the Superfund Program - Draft final - June 1989 EPA901/5-89-001)
- Adult body weight = 70 Kg ; Child body weight = 45 Kg
- Duration of Exposure = NUS estimates
  - 250 d/yr - Onsite person or worker
  - 52 d/yr - Occasional visitor to the site
  - 10 year per lifetime

Noncarcinogenic Dose Calculation:

$$Dose(mg/Kg/d) = \frac{C \times SA \times AF \times AR \times ER \times \frac{1 Kg}{10^6 mg}}{BW \times 365 d/yr}$$ where:

BW = Body Weight (Kg)
C = Contaminant Concentration (mg...
SA = Skin surface area exposed (c...
AF = Absorption fraction (unitl...
AR = Adherence Rate (mg/cm²-d
ER = Exposure rate (d/yr)

Example: C = 0.05 mg/Kg

$$Dose = \frac{0.05 mg/Kg \times 1800 cm^2 \times 0.05 \times 2.77 mg/cm^2/d \times \frac{250 d}{y} \times \frac{1 Kg}{10^6 mg}}{70 Kg \times 365 d/yr} = 1.22 \times 10^{-7} mg/Kg\text{-}d$$

Carcinogenic Dose Calculation:

$$Dose = \frac{0.05 mg/Kg \times 1800 cm^2 \times 0.05 \times 2.77 mg/cm^2/d \times 250 d/yr \times \frac{1 Kg}{10^6 mg} \times 10 yrs}{70 Kg \times 365 d/yr \times 70 yrs} = 1.74 \times 10^{-8}$$ mg/Kg-d

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 13,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
MAXIMUM CONTAMINANT LEVELS
WASTE PIT AREA - 70 KG RECEPTOR

DEX = Ci * AV * DA * F * AF

BW * LF

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAIALABLE FOR CONTACT (cm2)
DA = DUST ADHEREHENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVGERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.05	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.22E-07	1.74E-08		2.40E-01		4.18E-09	
4,4'-DDE	1.40	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	3.42E-06	4.88E-07		3.40E-01		1.66E-07	
4,4'-DDT	1.10	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	2.68E-06	3.83E-07	5.00E-04	3.40E-01	5.37E-03	1.30E-07	
DIELDREN	0.00	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.0000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	2.90	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	7.07E-06	1.01E-06	6.00E-05	1.30E+00	1.18E-01	1.31E-06	
ALPHA CHLORDANE	2.30	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	5.61E-06	8.01E-07	6.00E-05	1.30E+00	9.35E-02	1.04E-06	
HEPTACHLOR	0.00	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.04	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.02E-07	1.46E-08	1.30E-05	9.10E+00	7.38E-03	1.33E-07	
TOTAL													2.25E-01	2.79E-06	

4/6

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 13,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
AVERAGE CONTAMINANT LEVELS - POPISTIVE DETECTIONS ONLY
WASTE PIT AREA - 70 KG RECEPTOR

$$DEX = \frac{Ci * AV * DA * F * AF}{BW * LF}$$

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAIALABLE FOR CONTACT (cm2)
DA = DUST ADHEREHENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVGERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.05	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.22E-07	1.74E-08		2.40E-01		4.18E-09	
4,4'-DDE	0.73	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.78E-06	2.54E-07		3.40E-01		8.63E-08	
4,4'-DDT	0.70	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.70E-06	2.43E-07	5.00E-04	3.40E-01	3.40E-03	8.26E-08	
DIELDREN	0.00	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.0000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	2.90	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	7.07E-06	1.01E-06	6.00E-05	1.30E+00	1.18E-01	1.31E-06	
ALPHA CHLORDANE	2.30	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	5.61E-06	8.01E-07	6.00E-05	1.30E+00	9.35E-02	1.04E-06	
HEPTACHLOR	0.00	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.04	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.02E-07	1.46E-08	1.30E-05	9.10E+00	7.88E-03	1.33E-07	
TOTAL													2.23E-01	2.66E-06	

3/6

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 13,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
MAXIMUM CONTAMINANT LEVELS
WASTE PIT AREA - 45 KG RECEPTOR

$$DEX = \frac{Ci * AV * DA * F * AF}{BW * LF}$$

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAIALABLE FOR CONTACT (cm2)
DA = DUST ADHEREHENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVEERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.05	940.00	2.77	0.05	52.00	10.00	70.00	45.00	2.05E-08	2.94E-09		2.40E-01		7.07E-10	
4,4'-DDE	1.40	940.00	2.77	0.05	52.00	10.00	70.00	45.00	5.77E-07	8.24E-08		3.40E-01		2.80E-08	
4,4'-DDT	1.10	940.00	2.77	0.05	52.00	10.00	70.00	45.00	4.53E-07	6.48E-08	5.00E-04	3.40E-01	9.07E-04	2.20E-08	
DIELDREN	0.00	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.0000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	2.90	940.00	2.77	0.05	52.00	10.00	70.00	45.00	1.20E-06	1.71E-07	6.00E-05	1.30E+00	1.99E-02	2.22E-07	
ALPHA CHLORDANE	2.30	940.00	2.77	0.05	52.00	10.00	70.00	45.00	9.49E-07	1.35E-07	6.00E-05	1.30E+00	1.58E-02	1.76E-07	
HEPTACHLOR	0.00	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.04	940.00	2.77	0.05	52.00	10.00	70.00	45.00	1.73E-08	2.47E-09	1.30E-05	9.10E+00	1.33E-03	2.25E-08	
TOTAL													3.80E-02	4.71E-07	

4/6

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 10,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
AVERAGE CONTAMINANT LEVELS - POSITIVE DETECTIONS ONLY
WASTE PIT AREA - 45 KG RECEPTOR

$$DEX = \frac{Ci * AV * DA * F * AF}{BW * LF}$$

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAIALABLE FOR CONTACT (cm2)
DA = DUST ADHEREHENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVGERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.05	940.00	2.77	0.05	52.00	10.00	70.00	45.00	2.06E-08	2.94E-09		2.40E-01		7.07E-10	
4,4'-DDE	0.73	940.00	2.77	0.05	52.00	10.00	70.00	45.00	3.00E-07	4.29E-08		3.40E-01		1.46E-08	
4,4'-DDT	0.70	940.00	2.77	0.05	52.00	10.00	70.00	45.00	2.37E-07	4.15E-08	5.00E-04	3.40E-01	5.75E-04	1.40E-08	
DIELDREN	0.00	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.0000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	2.90	940.00	2.77	0.05	52.00	10.00	70.00	45.00	1.20E-06	1.71E-07	6.00E-05	1.30E+00	1.99E-02	2.22E-07	
ALPHA CHLORDANE	2.30	940.00	2.77	0.05	52.00	10.00	70.00	45.00	9.48E-07	1.35E-07	6.00E-05	1.30E+00	1.58E-02	1.76E-07	
HEPTACHLOR	0.00	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.04	940.00	2.77	0.05	52.00	10.00	70.00	45.00	1.73E-08	2.47E-09	1.30E-05	9.10E+00	1.33E-03	2.25E-09	
TOTAL													3.76E-02	4.50E-07	

5/6

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 13,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
AVERAGE CONTAMINANT LEVELS - NON DETECTS EQUAL ZERO
WASTE PIT AREA - 45 KG RECEPTOR

$$DEI = \frac{Ci * AV * DA * F * AF}{BW * LF}$$

WHERE: DEI = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAIALABLE FOR CONTACT (cm2)
DA = DUST ADHEREHENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVGERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.02	940.00	2.77	0.05	52.00	10.00	70.00	45.00	7.01E-09	1.00E-09		2.40E-01		2.40E-10	
4,4'-DDE	0.49	940.00	2.77	0.05	52.00	10.00	70.00	45.00	2.00E-07	2.86E-08		3.40E-01		9.71E-09	
4,4'-DDT	0.70	940.00	2.77	0.05	52.00	10.00	70.00	45.00	2.87E-07	4.10E-08	5.00E-04	3.40E-01	5.75E-04	1.40E-08	
DIELDREN	0.00	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.0000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.97	940.00	2.77	0.05	52.00	10.00	70.00	45.00	3.99E-07	5.69E-08	6.00E-05	1.30E+00	6.64E-03	7.40E-08	
ALPHA CHLORDANE	0.77	940.00	2.77	0.05	52.00	10.00	70.00	45.00	3.16E-07	4.51E-08	6.00E-05	1.30E+00	5.26E-03	5.86E-08	
HEPTACHLOR	0.00	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.01	940.00	2.77	0.05	52.00	10.00	70.00	45.00	5.77E-09	8.24E-10	1.30E-05	9.10E+00	4.44E-04	7.50E-09	
TOTAL													1.29E-02	1.64E-07	

61.

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 13,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
ARITHMETIC AVERAGE - NONDETECTS EQUAL 1/2 CRDL
WASTE PIT AREA - 70 KG ADULT

$$DEX = \frac{Ci * AV * DA * F * AF}{BW * LF}$$

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAIALABLE FOR CONTACT (cm2)
DA = DUST ADHEREHENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVGERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.022	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	5.37E-08	7.67E-09		2.40E-01		1.84E-09	
4,4'-DDE	0.488	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.19E-06	1.70E-07		3.40E-01		5.79E-08	
4,4'-DDT	0.697	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.70E-06	2.43E-07	5.00E-04	3.40E-01	3.40E-03	8.26E-08	
DIELDREN	0.000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.993	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	2.42E-06	3.46E-07	6.00E-05	1.30E+00	4.04E-02	4.50E-07	
ALPHA CHLORDANE	0.769	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	1.88E-06	2.68E-07	6.00E-05	1.30E+00	3.13E-02	3.48E-07	
HEPTACHLOR	0.000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.017	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	4.15E-08	5.92E-09	1.30E-05	9.10E+00	3.19E-03	5.39E-08	
TOTAL													7.82E-02	9.94E-07	

1/4

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 13, 1990

DERMAL ABSORPTION EXPOSURE SCENARIO
GEOMETRIC MEAN - NONDETECTS EQUAL 1/2 CRDL
WASTE PIT AREA - 70 KG ADULT

$$DEX = \frac{Ci * AV * DA * F * AF}{BW * LF}$$

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAILABLE FOR CONTACT (cm2)
DA = DUST ADHEREHENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVGERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.015	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	3.66E-08	5.23E-09		2.40E-01		1.25E-09	
4,4'-DDE	0.086	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	2.10E-07	3.00E-08		3.40E-01		1.02E-08	
4,4'-DDT	0.397	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	9.68E-07	1.38E-07	5.00E-04	3.40E-01	1.94E-03	4.70E-08	
DIELDREN	0.000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.168	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	4.10E-07	5.85E-08	6.00E-05	1.30E+00	6.83E-03	7.61E-06	
ALPHA CHLORDANE	0.211	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	5.15E-07	7.35E-08	6.00E-05	1.30E+00	8.58E-03	9.56E-08	
HEPTACHLOR	0.000	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.009	1800.00	2.77	0.05	250.00	10.00	70.00	70.00	2.20E-08	3.14E-09	1.30E-05	9.10E+00	1.69E-03	2.85E-08	
TOTAL													1.90E-02	2.59E-07	

3/4

SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
APRIL 10,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
GEOMETRIC MEAN - NON DETECTS EQUAL 1/2 CRDL
WASTE PIT AREA - 45 KG RECEPTOR

$$DEX = \frac{Ci * AV * DA * F * AF}{BW * LF}$$

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAILABLE FOR CONTACT (cm2)
DA = DUST ADHERENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS) OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCARC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.015	940.00	2.77	0.05	52.00	10.00	70.00	45.00	6.13E-09	8.83E-10		2.40E-01		2.12E-10	
4,4'-DDE	0.096	940.00	2.77	0.05	52.00	10.00	70.00	45.00	3.54E-08	5.06E-09		3.40E-01		1.72E-09	
4,4'-DDT	0.397	940.00	2.77	0.05	52.00	10.00	70.00	45.00	1.64E-07	2.34E-08	5.00E-04	3.40E-01	3.27E-04	7.95E-09	
DIELDREN	0.000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.165	940.00	2.77	0.05	52.00	10.00	70.00	45.00	6.72E-08	9.89E-09	6.00E-05	1.30E+00	1.12E-03	1.29E-08	
ALPHA CHLORDANE	0.211	940.00	2.77	0.05	52.00	10.00	70.00	45.00	8.70E-08	1.24E-08	6.00E-05	1.30E+00	1.45E-03	1.62E-08	
HEPTACHLOR	0.000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.009	940.00	2.77	0.05	52.00	10.00	70.00	45.00	3.71E-09	5.30E-10	1.30E-05	9.10E+00	2.85E-04	4.82E-09	
TOTAL													3.22E-03	4.37E-08	

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 13,1990

DERMAL ABSORPTION EXPOSURE SCENARIO
ARITHMETIC AVERAGE - NONDETECTS EQUAL 1/2 CRDL
WASTE PIT AREA - 45 KG RECEPTOR

DEX = Ci * AV * DA * F * AF

BW * LF

WHERE: DEX = DERMAL EXPOSURE (mg/kg/day)
Ci = CONCENTRATION OF CONTAMINANT (mg/kg)
AV = SKIN SURFACE AVAILABLE FOR CONTACT (cm2)
DA = DUST ADHERENCE (mg/cm2)
AF = ABSORBED FRACTION (DECIMAL)
F = FREQUENCY OF EXPOSURE EVENTS PER LIFETIME
BW = AVERAGE BODY WEIGHT (kg)
LF = LIFETIME (YRS, OMITTED FOR NONCARCINOGENS

CONTAMINANT	CONCENTRATION mg/kg	SURFACE AREA cm2	DUST ADHERENCE mg/cm2-day	ABSORBED FRACTION %	EXPOSURE DURATION days/year	YEARS EXPOSED years	LIFETIME years	BODY WEIGHT kg	NONCANC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	REFERENCE DOSE mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.022	940.00	2.77	0.05	52.00	10.00	70.00	45.00	9.07E-09	1.30E-09		2.40E-01		3.11E-10	
4,4'-DDE	0.488	940.00	2.77	0.05	52.00	10.00	70.00	45.00	2.01E-07	2.87E-08		3.40E-01		9.77E-09	
4,4'-DDT	0.697	940.00	2.77	0.05	52.00	10.00	70.00	45.00	2.87E-07	4.10E-08	5.00E-04	3.40E-01	5.75E-04	1.40E-08	
DIELDREN	0.000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-05	1.60E+01	0.00E+00	0.00E+00	
DELTA BHC	0.000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.993	940.00	2.77	0.05	52.00	10.00	70.00	45.00	4.09E-07	5.85E-08	6.00E-05	1.30E+00	6.82E-03	7.60E-08	
ALPHA CHLORDANE	0.769	940.00	2.77	0.05	52.00	10.00	70.00	45.00	3.17E-07	4.53E-08	6.00E-05	1.30E+00	5.28E-03	5.89E-08	
HEPTACHLOR	0.000	940.00	2.77	0.05	52.00	10.00	70.00	45.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.017	940.00	2.77	0.05	52.00	10.00	70.00	45.00	7.01E-09	1.00E-09	1.30E-05	9.10E+00	5.39E-04	9.11E-09	
TOTAL													1.32E-02	1.68E-07	

4/4

Appendix H

Risk Analysis Calculations and Results

Industrial Waste Pit Site

Evaluation of the Accidental Ingestion
of Surface Soil Contaminants

CLIENT: Sheppard AFB	FILE NO.: 7863	BY: L.A. Sinagoga	PAGE 1 OF 8
SUBJECT: Accidental Ingestion of Surface Soil Contaminants		CHECKED BY: DMZ	DATE: 4/10/90

Purpose: Evaluate carcinogenic/noncarcinogenic health risks associated w/accidental ingestion of surface soils

Assumptions:
- Adult body weight = 70Kg ; child body weight = 45Kg
- Duration of exposure = (NUS Estimates)
  - 250d/yr - onsite personnel / worker
  - 52d/yr - Occasional visitor to the site
  - 10 years per lifetime
- Amount ingestion = 0.050 gm/d (i.e. 50% of daily amount predicted by EPA to account for the fact that receptor does not live on the site)
- Absorped fraction = 100%

where: BW = Body Weight (Kg)
C = Contaminant Conc. (mg/Kg)
IR = Ingestion Rate (gm/d)
AF = Absorption fraction
ER = Exposure Rate = d/yr

<u>Noncarcinogenic Dose Calculation</u>:

$$\text{Dose (mg/Kg/d)} = \frac{C \times IR \times AF \times ER \times 1\,\text{Kg}/10^3\,\text{gm}}{BW \times 365\,\text{d/yr}}$$

<u>Example</u>: C = 0.05 mg/Kg

$$\text{Dose (mg/Kg/d)} = \frac{0.05\,\text{mg/Kg} \times 0.05\,\text{gm/d} \times 1 \times 250\,\text{d/yr} \times 1\,\text{Kg}/10^3\,\text{gm}}{70\,\text{Kg} \times 365\,\text{d/yr}} = 2.45 \times 10^{-8}\,\text{mg/Kg/d}$$

<u>Carcinogenic Dose Calculation:</u>

$$\text{Dose (mg/Kg/d)} = \frac{0.05\,\text{mg/Kg} \times 0.05\,\text{gm/d} \times 1 \times 250\,\text{d/yr} \times 10\,\text{yrs} \times 1\,\text{Kg}/10^3\,\text{gm}}{70\,\text{Kg} \times 365\,\text{d/yr} \times 70\,\text{yr}}$$

$$= 3.49 \times 10^{-9}$$

SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
APRIL 19,1989

ACCIDENTAL INGESTION EXPOSURE SCENARIO
MAXIMUM CONTAMINANT LEVELS
WASTE PIT AREA - ADULT RECEPTOR

$$EAI = \frac{C * AI * AF * ED * YE}{BW * LF}$$

WHERE: EAI = ACCIDENTAL INGESTION EXPOSURE
C = CONCENTRATION OF CONTAMINANT (mg/kg)
AI = AMOUNT OF SOIL INGESTED (g/day)
AF = ABSORBED FRACTION (DECIMAL)
ED = EXPOSURE DURATION (DAY/YR)
YE = YEARS OF EXPOSURE (YEAR)
BW = BODY WEIGHT (kg)
LF = LIFETIME (YRS * DAYS/YR)

CONTAMINANT	CONCENTRATION mg/kg	AMOUNT INGESTED g/day	ABSORBED FRACTION %	EXPOSURE DURATION days/yr	YEARS EXPOSED yrs	BODY WEIGHT kg	LIFETIME yrs	NONCARC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	RfD mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.05	0.05	100.00	250.00	10.00	70.00	70.00	2.45E-08 ✓	3.49E-09		2.40E-01		8.39E-10	
4,4'-DDE	1.40	0.05	100.00	250.00	10.00	70.00	70.00	6.85E-07	9.78E-08		3.40E-01		3.33E-08	
4,4'-DDT	1.10	0.05	100.00	250.00	10.00	70.00	70.00	5.38E-07	7.69E-08	5.00E-04	3.40E-01	1.08E-03	2.61E-08	
DIELDRIN	0.00	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.61E+01	0.00E+00	0.00E+00	
DELTA-BHC	0.00	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	2.90	0.05	100.00	250.00	10.00	70.00	70.00	1.42E-06	2.03E-07	6.00E-05	1.30E+00	2.36E-02	2.63E-07	
ALPHA CHLORDANE	2.30	0.05	100.00	250.00	10.00	70.00	70.00	1.13E-06	1.61E-07	6.00E-05	1.30E+00	1.88E-02	2.09E-07	
HEPTACHLOR	0.00	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.04	0.05	100.00	250.00	10.00	70.00	70.00	2.05E-08	2.94E-09	1.30E-05	9.10E+00	1.58E-03	2.67E-08	
CADMIUM	34.30	0.05	100.00	250.00	10.00	70.00	70.00	1.68E-05	2.40E-06	5.00E-04		3.36E-02		
CHROMIUM	840.00	0.05	100.00	250.00	10.00	70.00	70.00	4.11E-04	5.87E-05	5.00E-03		8.22E-02		HEX CHROME
LEAD	180.00	0.05	100.00	250.00	10.00	70.00	70.00	8.81E-05	1.26E-05	1.40E-03		6.29E-02		TENT VALUE
ZINC	450.00	0.05	100.00	250.00	10.00	70.00	70.00	2.20E-04	3.15E-05	2.00E-01		1.10E-03		
TOTAL												2.25E-01	5.59E-07	

2/8

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 10,1987

ACCIDENTAL INGESTION EXPOSURE SCENARIO
AVERAGE CONTAMINANT LEVELS - POSITIVE DETECTIONS ONLY
WASTE PIT AREA - ADULT RECEPTOR

EAI = C * AI * AF * ED * YE

BW * LF

WHERE: EAI = ACCIDENTAL INGESTION EXPOSURE
C = CONCENTRATION OF CONTAMINANT (mg/kg)
AI = AMOUNT OF SOIL INGESTED (g/day)
AF = ADSORBED FRACTION (DECIMAL)
ED = EXPOSURE DURATION (DAY/YR)
YE = YEARS OF EXPOSURE (YEAR)
BW = BODY WEIGHT (kg)
LF = LIFETIME (YRS * DAYS/YR)

CONTAMINANT	CONCENTRATION mg/kg	AMOUNT INGESTED g/day	ABSORBED FRACTION %	EXPOSURE DURATION days/yr	YEARS EXPOSED yrs	BODY WEIGHT kg	LIFETIME yrs	NONCARC DOSE mg/kg/day	CARC DOSE mg/kg/day-1	RfD mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.05	0.05	100.00	250.00	10.00	70.00	70.00	2.45E-08	3.49E-09		2.40E-01		8.39E-10	
4,4'-DDE	0.73	0.05	100.00	250.00	10.00	70.00	70.00	3.56E-07	5.09E-08		3.40E-01		1.73E-08	
4,4'-DDT	0.70	0.05	100.00	250.00	10.00	70.00	70.00	3.41E-07	4.87E-08	5.00E-04	3.40E-01	6.82E-04	1.66E-08	
DIELDRIN	0.00	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.61E+01	0.00E+00	0.00E+00	
DELTA-BHC	0.00	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	2.70	0.05	100.00	250.00	10.00	70.00	70.00	1.42E-06	2.03E-07	6.00E-05	1.30E+00	2.36E-02	2.63E-07	
ALPHA CHLORDANE	2.30	0.05	100.00	250.00	10.00	70.00	70.00	1.13E-06	1.61E-07	6.00E-05	1.30E+00	1.88E-02	2.09E-07	
HEPTACHLOR	0.00	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.04	0.05	100.00	250.00	10.00	70.00	70.00	2.05E-08	2.94E-09	1.30E-05	9.10E+00	1.58E-03	2.67E-08	
CADMIUM	34.30	0.05	100.00	250.00	10.00	70.00	70.00	1.68E-05	2.40E-06	5.00E-04		3.36E-02		
CHROMIUM	425.00	0.05	100.00	250.00	10.00	70.00	70.00	2.08E-04	2.97E-05	5.00E-03		4.16E-02		HEX CHROME
LEAD	106.20	0.05	100.00	250.00	10.00	70.00	70.00	5.20E-05	7.42E-06	1.40E-03		3.71E-02		TENT VALUE
ZINC	241.70	0.05	100.00	250.00	10.00	70.00	70.00	1.18E-04	1.69E-05	2.00E-01		5.91E-04		
TOTAL												1.35E-01	5.34E-07	

3/8

SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
APRIL 10,199[illegible]

ACCIDENTAL INGESTION EXPOSURE SCENARIO
GEOMETRIC MEAN - NONDETECTS EQUAL 1/2 CRQL
WASTE PIT AREA - 70 KG RECEPTOR

$$EAI = \frac{C * AI * AF * ED * YE}{BW * LF}$$

WHERE: EAI = ACCIDENTAL INGESTION EXPOSURE
C = CONCENTRATION OF CONTAMINANT (mg/kg)
AI = AMOUNT OF SOIL INGESTED (g/day)
AF = ABSORBED FRACTION (DECIMAL)
ED = EXPOSURE DURATION (DAY/YR)
YE = YEARS OF EXPOSURE (YEAR)
BW = BODY WEIGHT (Kg)
LF = LIFETIME (YRS * DAYS/YR)

CONTAMINANT	CONCENTRATION	AMOUNT INGESTED	ABSORBED FRACTION	EXPOSURE DURATION	YEARS EXPOSED	BODY WEIGHT	LIFETIME	NONCARC DOSE	CARC DOSE	RFD	CPF	NONCANCER RISK	CANCER RISK	COMMENT
	mg/kg	g/day	%	days/yr	yrs	(kg)	yrs	(mg/kg/day)	mg/kg/day-1	mg/kg/day	(kg-day/mg)			
4,4'-DDD	0.015	0.05	100.00	250.00	10.00	70.00	70.00	7.19E-09	1.03E-09		2.40E-01		2.47E-10	
4,4'-DDE	0.056	0.05	100.00	250.00	10.00	70.00	70.00	4.22E-09	6.03E-09		3.40E-01		2.05E-09	
4,4'-DDT	0.397	0.05	100.00	250.00	10.00	70.00	70.00	1.94E-07	2.77E-08	5.00E-04	3.40E-01	3.88E-04	9.42E-09	
DIELDRIN	0.000	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.61E+01	0.00E+00	0.00E+00	
DELTA-BHC	0.000	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.166	0.05	100.00	250.00	10.00	70.00	70.00	[illegible]	[illegible]	6.00E-05	1.30E+00	1.[illegible]E-03	1.53E-08	
ALPHA CHLORDANE	0.211	0.05	100.00	250.00	10.00	70.00	70.00	1.03E-07	1.47E-08	6.00E-05	1.30E+00	1.72E-03	1.92E-08	
HEPTACHLOR	0.000	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.009	0.05	100.00	250.00	10.00	70.00	70.00	4.31E-09	6.16E-10	1.30E-05	9.10E+00	3.31E-04	5.60E-09	
CADMIUM	4.100	0.05	100.00	250.00	10.00	70.00	70.00	2.01E-06	2.87E-07	1.00E-03		2.01E-03		
CHROMIUM	92.000	0.05	100.00	250.00	10.00	70.00	70.00	4.50E-05	6.43E-06	5.00E-03		9.00E-03		HEX CHROME
LEAD	76.000	0.05	100.00	250.00	10.00	70.00	70.00	3.72E-05	5.31E-06	1.40E-03		2.66E-02		TENT VALUE
ZINC	122.000	0.05	100.00	250.00	10.00	70.00	70.00	5.97E-05	8.53E-06	2.00E-01		2.98E-04		
TOTAL												4.37E-02	5.17E-08	

4/8

SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
APRIL 10,1989

ACCIDENTAL INGESTION EXPOSURE SCENARIO
ARITHMETIC MEAN - NONDETECTS EQUAL 1/2 CRQL
WASTE PIT AREA - 70 KG RECEPTOR

$$EAI = \frac{C * AI * AF * ED * YE}{BW * LF}$$

WHERE: EAI = ACCIDENTAL INGESTION EXPOSURE
C = CONCENTRATION OF CONTAMINANT (mg/kg)
AI = AMOUNT OF SOIL INGESTED (g/day)
AF = ABSORBED FRACTION (DECIMAL)
ED = EXPOSURE DURATION (DAY/YR)
YE = YEARS OF EXPOSURE (YEAR)
BW = BODY WEIGHT (kg)
LF = LIFETIME (YRS * DAYS/YR)

CONTAMINANT	CONCENTRATION mg/kg	AMOUNT INGESTED g/day	ABSORBED FRACTION %	EXPOSURE DURATION days/yr	YEARS EXPOSED yrs	BODY WEIGHT kg	LIFETIME yrs	NONCARC DOSE mg/kg/day	CARC DOSE mg/kg-day-1	RfD mg/kg-day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.032	0.05	100.00	250.00	10.00	70.00	70.00	1.08E-08	1.54E-09		2.40E-01		3.69E-10	
4,4'-DDE	0.488	0.05	100.00	250.00	10.00	70.00	70.00	2.39E-07	3.41E-08		3.40E-01		1.16E-08	
4,4'-DDT	0.697	0.05	100.00	250.00	10.00	70.00	70.00	3.41E-07	4.87E-08	5.00E-04	3.40E-01	6.82E-04	1.66E-08	
DIELDRIN	0.000	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.61E+01	0.00E+00	0.00E+00	
DELTA-BHC	0.000	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.993	0.05	100.00	250.00	10.00	70.00	70.00	4.86E-07	6.94E-08	6.00E-05	1.30E+00	8.10E-03	9.02E-08	
ALPHA CHLORDANE	0.769	0.05	100.00	250.00	10.00	70.00	70.00	3.76E-07	5.37E-08	6.00E-05	1.30E+00	6.27E-03	6.98E-08	
HEPTACHLOR	0.000	0.05	100.00	250.00	10.00	70.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.017	0.05	100.00	250.00	10.00	70.00	70.00	8.17E-09	1.17E-09	1.30E-05	9.10E+00	6.28E-04	1.06E-08	
CADMIUM	17.400	0.05	100.00	250.00	10.00	70.00	70.00	8.51E-06	1.22E-06	5.00E-04		1.70E-02		
CHROMIUM	425.000	0.05	100.00	250.00	10.00	70.00	70.00	2.08E-04	2.97E-05	5.00E-03		4.16E-02		HEX CHROME
LEAD	105.200	0.05	100.00	250.00	10.00	70.00	70.00	5.20E-05	7.42E-06	1.40E-03		3.71E-02		TENT VALUE
ZINC	241.700	0.05	100.00	250.00	10.00	70.00	70.00	1.18E-04	1.69E-05	2.00E-01		5.91E-04		
TOTAL												1.12E-01	1.99E-07	

5/8

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 10,1989

ACCIDENTAL INGESTION EXPOSURE SCENARIO
MAXIMUM CONTAMINANT LEVELS
WASTE PIT AREA - 45 KG CHILD

$$EAI = \frac{C * AI * AF * ED * YE}{BW * LF}$$

WHERE: EAI = ACCIDENTAL INGESTION EXPOSURE
C = CONCENTRATION OF CONTAMINANT (mg/kg)
AI = AMOUNT OF SOIL INGESTED (g/day)
AF = ABSORBED FRACTION (DECIMAL)
ED = EXPOSURE DURATION (DAY/YR)
YE = YEARS OF EXPOSURE (YEAR)
BW = BODY WEIGHT (kg)
LF = LIFETIME (YRS * DAYS/YR)

CONTAMINANT	CONCENTRATION mg/kg	AMOUNT INGESTED g/day	ABSORBED FRACTION %	EXPOSURE DURATION days/yr	YEARS EXPOSED yrs	BODY WEIGHT kg	LIFETIME yrs	NONCARC DOSE mg/kg/day	CARC DOSE (mg/kg/day)-1	RfD mg/kg/day	CPF (mg/kg/day)-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.050	0.05	100.00	52.00	10.00	45.00	70.00	7.91E-09	1.13E-09		2.40E-01		2.71E-10	
4,4'-DDE	1.400	0.05	100.00	52.00	10.00	45.00	70.00	2.22E-07	3.17E-08		3.40E-01		1.08E-08	
4,4'-DDT	1.100	0.05	100.00	52.00	10.00	45.00	70.00	1.74E-07	2.49E-08	5.00E-04	3.40E-01	3.48E-04	8.46E-09	
DIELDREN	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.61E+01	0.00E+00	0.00E+00	
DELTA-BHC	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	2.900	0.05	100.00	52.00	10.00	45.00	70.00	4.59E-07	6.56E-08	6.00E-05	1.30E+00	7.65E-03	8.53E-08	
ALPHA CHLORDANE	2.300	0.05	100.00	52.00	10.00	45.00	70.00	3.64E-07	5.20E-08	6.00E-05	1.30E+00	6.07E-03	6.76E-08	
HEPTACHLOR	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.042	0.05	100.00	52.00	10.00	45.00	70.00	6.65E-09	9.50E-10	1.30E-05	9.10E+00	5.11E-04	8.64E-09	
CADMIUM	34.300	0.05	100.00	52.00	10.00	45.00	70.00	5.43E-06	7.76E-07	5.00E-04		1.09E-02		
CHROMIUM	640.000	0.05	100.00	52.00	10.00	45.00	70.00	1.33E-04	1.90E-05	5.00E-03		2.66E-02		HEX CHROME
LEAD	180.000	0.05	100.00	52.00	10.00	45.00	70.00	2.85E-05	4.07E-06	1.40E-03		2.04E-02		TENT VALUE
ZINC	450.000	0.05	100.00	52.00	10.00	45.00	70.00	7.12E-05	1.02E-05	2.00E-01		3.56E-04		
TOTAL												7.27E-02	1.81E-07	

6/8

SHEPPARD AIR FORCE BASE
WITCHITA FALLS, TEXAS
APRIL 10,1995

ACCIDENTAL INGESTION EXPOSURE SCENARIO
ARITHMETIC MEAN - NONDETECTS EQUAL 1/2 CRQL
WASTE PIT AREA - 45 KG CHILD

$$EAI = \frac{C * AI * AF * ED * YE}{BW * LF}$$

WHERE: EAI = ACCIDENTAL INGESTION EXPOSURE
C = CONCENTRATION OF CONTAMINANT (mg/kg)
AI = AMOUNT OF SOIL INGESTED (g/day)
AF = ABSORBED FRACTION (DECIMAL)
ED = EXPOSURE DURATION (DAY/YR)
YE = YEARS OF EXPOSURE (YEAR)
BW = BODY WEIGHT (Kg)
LF = LIFETIME (YRS * DAYS/YR)

CONTAMINANT	CONCENTRATION	AMOUNT INGESTED	ABSORBED FRACTION	EXPOSURE DURATION	YEARS EXPOSED	BODY WEIGHT	LIFETIME	NONCARC DOSE	CARC DOSE	RfD	CPF	NONCANCER RISK	CANCER RISK	COMMENT
	mg/kg	g/day	%	days/yr	yrs	kg	yrs	mg/kg/day	mg/kg/day-1	mg/kg/day	(mg/kg/day)-1			
4,4'-DDD	0.022	0.05	100.00	52.00	10.00	45.00	70.00	3.48E-09	4.97E-10		2.40E-01		1.19E-10	
4,4'-DDE	0.468	0.05	100.00	52.00	10.00	45.00	70.00	7.72E-08	1.10E-08		3.40E-01		3.75E-09	
4,4'-DDT	0.697	0.05	100.00	52.00	10.00	45.00	70.00	1.10E-07	1.58E-08	5.00E-04	3.40E-01	2.21E-04	5.36E-09	
DIELDREN	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.61E+01	0.00E+00	0.00E+00	
DELTA-BHC	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.793	0.05	100.00	52.00	10.00	45.00	70.00	1.37E-07	1.95E-08	6.00E-05	1.30E+00	2.62E-03	2.52E-08	
ALPHA CHLORDANE	0.769	0.05	100.00	52.00	10.00	45.00	70.00	1.22E-07	1.74E-08	6.00E-05	1.30E+00	2.03E-03	2.26E-08	
HEPTACHLOR	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.017	0.05	100.00	52.00	10.00	45.00	70.00	2.56E-09	3.73E-10	1.30E-05	9.10E+00	2.07E-04	3.44E-09	
CADMIUM	17.400	0.05	100.00	52.00	10.00	45.00	70.00	2.75E-06	3.93E-07	5.00E-04		5.51E-03		
CHROMIUM	425.000	0.05	100.00	52.00	10.00	45.00	70.00	6.73E-05	9.61E-06	5.00E-03		1.35E-02		HEX CHROME
LEAD	106.290	0.05	100.00	52.00	10.00	45.00	70.00	1.68E-05	2.40E-06	1.40E-03		1.20E-02		TENT VALUE
ZINC	241.700	0.05	100.00	52.00	10.00	45.00	70.00	3.83E-05	5.47E-06	2.00E-01		1.91E-04		
TOTAL												3.62E-02	5.45E-05	

SHEPPARD AIR FORCE BASE
WICHITA FALLS, TEXAS
APRIL 10,1989

ACCIDENTAL INGESTION EXPOSURE SCENARIO
GEOMETRIC MEAN - NONDETECTS EQUAL 1/2 CRDL
WASTE PIT AREA - 45 KG CHILD

$$EAI = \frac{C * AI * AF * ED * YE}{BW * LF}$$

WHERE: EAI = ACCIDENTAL INGESTION EXPOSURE
C = CONCENTRATION OF CONTAMINANT (mg/kg)
AI = AMOUNT OF SOIL INGESTED (g/day)
AF = ABSORBED FRACTION (DECIMAL)
ED = EXPOSURE DURATION (DAY/YR)
YE = YEARS OF EXPOSURE (YEARS)
BW = BODY WEIGHT (kg)
LF = LIFETIME (YRS * DAYS/YR)

CONTAMINANT	CONCENTRATION mg/kg	AMOUNT INGESTED g/day	ABSORBED FRACTION %	EXPOSURE DURATION days/yr	YEARS EXPOSED yrs	BODY WEIGHT kg	LIFETIME yrs	NONCARC DOSE mg/kg-day	CARC DOSE mg/kg/day-1	RfD mg/kg/day	CPF mg/kg/day-1	NONCANCER RISK	CANCER RISK	COMMENT
4,4'-DDD	0.015	0.05	100.00	52.00	10.00	45.00	70.00	2.33E-09	3.32E-10		2.40E-01		7.95E-11	
4,4'-DDE	0.086	0.05	100.00	52.00	10.00	45.00	70.00	1.36E-08	1.94E-09		3.40E-01		6.61E-10	
4,4'-DDT	0.397	0.05	100.00	52.00	10.00	45.00	70.00	6.28E-08	8.98E-09	5.00E-04	3.40E-01	1.26E-04	3.05E-09	
DIELDREN	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00	5.00E-05	1.61E+01	0.00E+00	0.00E+00	
DELTA-BHC	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00				0.00E+00	
GAMMA CHLORDANE	0.156	0.05	100.00	52.00	10.00	45.00	70.00	2.66E-08	3.80E-09	6.00E-05	1.30E+00	4.43E-04	4.94E-09	
ALPHA CHLORDANE	0.211	0.05	100.00	52.00	10.00	45.00	70.00	3.34E-08	4.77E-09	6.00E-05	1.30E+00	5.57E-04	6.20E-09	
HEPTACHLOR	0.000	0.05	100.00	52.00	10.00	45.00	70.00	0.00E+00	0.00E+00	5.00E-04	4.50E+00	0.00E+00	0.00E+00	
HEPTACHLOR EPOXIDE	0.009	0.05	100.00	52.00	10.00	45.00	70.00	1.39E-09	1.99E-10	1.30E-05	9.10E+00	1.07E-04	1.81E-09	
CADMIUM	4.100	0.05	100.00	52.00	10.00	45.00	70.00	6.49E-07	9.27E-08	5.00E-04		1.30E-03		
CHROMIUM	92.000	0.05	100.00	52.00	10.00	45.00	70.00	1.46E-05	2.08E-06	5.00E-03		2.91E-03		HEX CHROME
LEAD	76.000	0.05	100.00	52.00	10.00	45.00	70.00	1.20E-05	1.72E-06	1.40E-03		8.59E-03		TENT VALUE
ZINC	122.000	0.05	100.00	52.00	10.00	45.00	70.00	1.93E-05	2.76E-06	2.00E-01		9.66E-05		
TOTAL												1.41E-02	1.67E-08	

8/8

Appendix H

Risk Analysis Calculations and Results

Groundwater Contamination at Various Sites at Sheppard Air Force Base.

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Sheppard AFB	FILE NO.: 7863	BY: L.H. Siragoga	PAGE 1 OF 4
SUBJECT: Site 8 Groundwater		CHECKED BY: DMZ	DATE: 4-10-90

Evaluation of Phase II VOC and Pesticide levels detected in groundwater assuming the ground water is utilized as a domestic water supply source.

Contaminant	Max. Cont. Level	Exposure Dose	RfD Dose	HQ	CPF	ELCR
Benzene	2	5.7×10^{-5}			2.9×10^{-2}	1.7×10^{-6}
1,2-Dichloroethane	1	2.86×10^{-5}			9.1×10^{-2}	2.6×10^{-6}
Trichloroethene	1	2.86×10^{-5}			1.1×10^{-2}	3.14×10^{-7}
alpha chlordane	2.7	7.7×10^{-5}	6×10^{-5}	1.3	1.3	1×10^{-4}
Beta - BHC	0.21	6×10^{-6}	3×10^{-3}	0.002	1.8	1.1×10^{-5}
Heptachlor	0.15	4.3×10^{-6}	5×10^{-4}	0.009	4.5	1.9×10^{-5}
Gamma Chlordane	2.0	5.7×10^{-5}	6×10^{-5}	0.95	1.3	7.4×10^{-5}
Chlordane	1.5 (found in DC=0)	4.3×10^{-5}	6×10^{-5}	0.72	1.3	5.6×10^{-5}

$$\text{Exposure Dose} = \frac{C(\mu g/l) \times IR(l/d) \times 0.001 (mg/\mu g)}{BW(kg)} = [\mu g/l] \times 2.86\times10^{-5}$$

where: C = Contaminant concentration in the groundwater ($\mu g/l$)
IR = Ingestion Rate (l/d)
BW = Body Weight (Kg)

$$HQ = \frac{\text{Exposure dose}}{\text{Reference dose (RfD)}} \quad \text{Example: } \frac{4.3\times10^{-5}}{6\times10^{-5}} = 0.72$$

Excess lifetime cancer risk (ELCR) = Exposure Dose $\times$ CPF
Example: $4.3\times10^{-5} \times 1.3 = 5.6\times10^{-5}$

Note: If a 45Kg child is the receptor of concern, the hazard quotient calculated would increase by a factor of 1.6.

If a 10Kg child (1 l/d intake rate) is the receptor of concern, the hazard quotient calculated would increase by a factor of 3.5.

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: Sheppard AFB	FILE NO.: 7863	BY: L.N. Smagoga	PAGE 2 OF 4
SUBJECT: Site 2 - groundwater - Arsenic Contamination		CHECKED BY:	DATE: 4/10/90

and Site 4 - Antimony Contamination

Evaluation of Arsenic contamination in phase II groundwater - Site 2:

$C_{max} = 109\ \mu g/l$ $\quad RfD_{As} = 0.001$ mg/kg/d

C_{ave}(arithmetic - NDs = 0) = 49.7 μg/l $\quad CPF_{As} = 1.8$

For maximum concentrations:

$$Dose = \frac{109\,\mu g/l \times 2\,l/d \times 0.001\,mg/\mu g}{70\,Kg} = 3.1\times10^{-3}$$

$$\text{Hazard Quotient: } \frac{3.1\times10^{-3}\,mg/kg/d}{0.001\,mg/kg\,d} = 3.1$$

Excess lifetime Cancer Risk (ELCR): $3.1\times10^{-3} \times 1.8 = 5.6\times10^{-3}$

For Average Concentration:

$$Dose = \frac{49.7\,\mu g/l \times 2\,l/d \times 0.001\,mg/\mu g}{70\,Kg} = 1.42\times10^{-3}$$

$$\text{Hazard Quotient: } \frac{1.42\times10^{-3}}{0.001} = 1.42$$

$ELCR = 1.42\times10^{-3} \times 1.8 = 2.56\times10^{-3}$

Evaluation of Antimony - contamination in Site 4 surface water

$C_{max} = 55.5\ \mu g/l$ $\quad RfD_{Sb} = 4\times10^{-4}$

C_{ave} (arithmetic - ND = 0) = 27.5 μg/l

$$Dose = \frac{55\,\mu g/l \times 2\,l/d \times 0.001\,mg/\mu g}{70\,Kg} = 0.0016\,mg/Kg$$

$$\text{Hazard quotient} = \frac{0.0016\,mg/kg/d}{4\times10^{-4}\,mg/kg/d} = 3.9$$

NUS 155A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES STANDARD CALCULATION SHEET

CLIENT: Sheppard AFB	FILE NO.: 4563	BY: [illegible]	PAGE 3 OF 4
SUBJECT: Site 4 - Groundwater Contamination - Benzene and Fluoride / Site 5 Groundwater		CHECKED BY: [illegible]	DATE: 4/10/93

Evaluation of benzene and fluoride concentrations in Site 4 groundwater:

Cmax Benzene = 5 μg/l

Cave Benzene = 2.5 μg/l (arithmetic-NDs = 0)

Cmax Fluoride = 6.9 mg/l

Cave Fluoride = 3.0 mg/l (arithmetic-NDs = 0)

Cave Fluoride = 6.0 mg/l positive detections only)

CPF Benzene = 2.9×10^{-2}

RfD fluoride 6×10^{-2}

Contaminant	Exposure Conc μg/l	Exposure Dose mg/Kg/d	Hazard Quotient	Excess Lifetime Cancer Risk
Benzene	5	1.43×10^{-4}	–	4.14×10^{-6}
Benzene	2.5	7.2×10^{-5}	–	2.1×10^{-6}
Fluoride	6.9 mg/l	0.2	3.3	–
Fluoride	3.0 mg/l	0.09	1.43	–
Fluoride	6.0 mg/l	0.17	2.86	–

$$\text{Exposure Dose (mg/kg/d)} = \frac{C\,\mu g/l \times IR\,(l/d) \times 0.001\,mg/\mu g}{BW\,(kg)} = \mu g/l \times 2.86 \times 10^{-5}$$

Risk values for Site 5 groundwater are presented in attached Table

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GROUNDWATER RISK ANALYSIS RESULTS
SITE 5
SHEPPARD AIR FORCE BASE

Contaminant	Concentrations Detected	Exposure Dose (mg/kg/day)[1]	Reference Dose (mg/kg/day)	Hazard Quotient	CPF (mg/kg/day)-1	Excess Lifetime Cancer Risk
MAXIMUM CONTAMINANT LEVELS (PHASE I OR PHASE II)						
Bis(2-ethylhexyl)phthalate	110 (I)	3.1×10^{-3}	2×10^{-2}	0.14	1.4×10^{-2}	4.3×10^{-5}
Trichloroethene	3(II)	8.57×10^{-5}	NA	-	1.1×10^{-2}	9.4×10^{-7}
Chromium	1,850(II)	0.053	5×10^{-3}	10.6	NA	-
Nickel	248	0.0071	2×10^{-2}	0.36	NA	-
TOTAL						4.3×10^{-5}
AVERAGE CONTAMINANT LEVELS (POSITIVE DETECTIONS ONLY/ALL SAMPLES) (PHASE I OR PHASE II)						
Bis(2-ethylhexyl)phthalate	110/15.7 (I)	3.1×10^{-3}/ 4.5 10^{-4}	2×10^{-2}	0.16/0.02 0.16	1.4×10^{-2}	4.3×10^{-5}/ 6.3×10^{-6}
Trichloroethene	3/1.5 (II)	8.57×10^{-5}/ 4.3×10^{-5}	NA	-	1.1×10^{-2}	9.4×10^{-7}/ 4.7×10^{-7}
Chromium	977.5/977.5 (II)	0.028	5×10^{-3}	5.6	NA	-
Nickel	102.5/102.5 (II)	0.0029	2×10^{-2}	0.15	NA	-
TOTAL						4.4×10^{-5}/ 6.8×10^{-6}

1 Exposure dose estimated assuming receptor is routinely ingesting groundwater (groundwater used as a domestic water supply source). A 70 Kg adult is the receptor of concern.

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: Sheppard AFB	FILE NO.: [illegible]	BY: LA Smagoga	PAGE 4 OF 4
SUBJECT: Site 7 Groundwater		CHECKED BY: [illegible]	DATE: 4/10/92

Evaluation of Chromium and Nickel contaminations detected in Site 7 Groundwater

$RfD_{Cr} = 5 \times 10^{-3}$
$RfD_{Ni} = 2 \times 10^{-2}$

Cmax Nickel = 378 ug/l
Cmax chromium = 500 ug/l
Cave Nickel = 103 µg/l (Phase I positive detections only)
Cave Nickel = 41 µg/l (Phase I - all values - ND's assigned a value of zero.

Contaminant	Exposure Conc (ug/l)	Exposure Dose (mg/Kg/d)	Hazard Quotient	Excess Lifetime Cancer Risk
Chromium	500	0.014	2.86	—
chromium (500/6)	83	0.002	0.47	—
Nickel	378	0.0106	0.53	—
Nickel	103	0.0029	0.14	—
Nickel	41	0.0012	0.05	

Exposure dose and risk calculated for 70Kg adult per equations presented on page 1/4. Risk levels would increase by a factor of 1.6 and 3.5 if a 45Kg and 10Kg child, respectively, were evaluated as the receptors of concern.

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NUS CORPORATION AND SUBSIDIARIES	STANDARD CALCULATION SHEET

CLIENT:	FILE NO.:	BY:	PAGE 1 OF 1
SUBJECT: Site 8 - Surface Soil Results		CHECKED BY:	DATE: 4/10/90

Elevated metals concentrations:

			Phase II ≤	
Cadmium	- 34.3 mg/kg	Phase I	Cadmium	1.6 mg/kg
Chromium	- 10 - 870 mg/kg		Chromium	16.5 mg/kg
lead	- 180 mg/kg		Lead	89 mg/kg
Zinc	- 450 mg/Kg		Zinc	99.8 mg/kg

Phase II Pesticides

	Cmax
alpha-chlordane	- 2,300 ug/Kg
Heptachlor epoxide	- 42 ug/kg
4,4-DDT	- 1,100 ug/kg
4,4-DDD	- 50 ug/kg
4,4-DDE	- 1,400 ug/kg
gammachlordane	- 2,900 ug/kg

Reference Doses for metals

Cadmium - 5×10^{-4} water

Chromium - hex - 5×10^{-3}

Tri - 1

Lead - 1.4×10^{-3} (old value) SPHEM 1986

Zinc - 2×10^{-1}

Accidental Ingestion of Soils Equation:

N. C. Dose Adult (Ebbs Personnel) $= \dfrac{[\text{mg/kg}] \times 0.05\,\frac{\text{gm}}{\text{d}} \times 250\text{d} \times \frac{1\text{Kg}}{10^3\text{g}}}{70\text{Kg} \times 365}$

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NUS CORPORATION AND SUBSIDIARIES STANDARD CALCULATION SHEET

CLIENT: Sheppard AFB	FILE NO.:	BY: A. Sinagoga	PAGE 1 OF 1
SUBJECT: Site 3		CHECKED BY:	DATE: 4/10/90

Sediment Exposure - Evaluation of Elevated metal concentrations in Sediments. Exposure assumptions are identical to assumptions presented for accidental ingestion of soils exposure.

Exposure Dose (Base personnel) = $\frac{[mg/Kg] \times 0.05 g/day \times 250 d/yrs \times \frac{1 Kg}{10^3 gm}}{70 Kg \times 365 d/yr}$

$= [mg/Kg] \times 4.89 \times 10^{-7}$

Contaminant	Concentration	Exposure Dose	Hazard Quotient
Chromium	77.2	3.8×10^{-5}	0.008
Chromium	73.0	3.6×10^{-5}	0.007
Lead	120	5.9×10^{-5}	0.0419
Lead	99	4.8×10^{-5}	0.035
Zinc	130	6.6×10^{-5}	0.0003
Zinc	120	5.8×10^{-5}	0.00029

Exposure Dose (adolescent) = $\frac{[mg/Kg] \times 0.100 gm/day \times \frac{52 d}{yr} \times \frac{1 Kg}{10^3 gM}}{45 Kg \times 365 d/yr}$

$= [mg/Kg] \times 3.16 \times 10^{-7}$

Contaminant	Concentration	Exposure Dose	Hazard Quotient
Chromium	77.2	2.4×10^{-5}	0.005
Chromium	73	2.3×10^{-5}	0.005
Lead	120	3.8×10^{-5}	0.027
Lead	99	3.1×10^{-5}	0.022
Zinc	130	4.1×10^{-5}	0.0002
Zinc	120	3.79×10^{-5}	0.0002

APPENDIX I

FIGURE MAPS